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'Olympus 1' Communications Satellite Described

AN890155 Chichester INTERNATIONAL TELECOMMUNICATIONS INTELLIGENCE in English 14 Apr 89 pp 8-9]

[Article: "Olympus—The First of a New Generation"]

[Text] A revolutionary new generation of commercial satellites is embodied in the Olympus 1, which, when orbital, will be the most powerful civil communications satellite to traverse our skies.

The Olympus programme was originally conceived ten years ago, when ESA studies revealed the need for a new class of large, multipurpose communications satellite capable of providing higher power and carrying heavier payloads than the ECS or Marecs satellite types.

Olympus 1 is the pilot satellite which will serve as a technology demonstrator for future large, high-power, multipurpose civil communications satellites. It was built under contract for the European Space Agency (ESA) by a multinational consortium led by British Aerospace (Space Systems) Ltd, which, according to a spokesman for the company, ranks as the third largest manufacturer of commercial communications satellites in the Western world (following Hughes and General Electric of the US). The main subcontractors in the consortium are: Aeritalia and Selenia Spazio of Italy, Fokker of the Netherlands and Spar Aerospace of Canada. Eight of the thirteen European ESA member states and Canada are funding Olympus developments.

The latest reports reveal that, construction and earthbound testing complete, Olympus 1 has reached French Guiana, where it will be prepared for launching from the Kourou space center, aboard the Ariane space vehicle, in June of this year.

Four dedicated communications payloads are carried by the satellite with applications in high-power direct broadcast, data transmission, video conferencing and tele-educational services. These payloads will assist in the development of new communications services within Europe. Its solar arrays, which will measure 25.6 meters from tip to tip when the body is in orbit, will be capable of generating up to 3.6 kilowatts of electrical power—more power than any other civil three-axis stabilised communications satellite. BA is speculating that future Olympus satellites could support solar arrays spanning 56 meters and capable of providing up to 7.7 kilowatts—enough to power up to 250,000 simultaneous two-way telephone calls, or 40 channels of direct broadcast television. (Most civil communications satellites generate around one kilowatt of electricity.)

Through research into the improved efficiency of communications satellite, British Aerospace has suggested that satellite dishes for business communications, which today can measure as much as five meters in diameter, could be reduced to a meter or less, bringing costs down by a factor of ten.

It is expected that Olympus 1 will stimulate fresh interest in new satellite services and techniques through working the demonstration of communications payload hardware to future mission requirements [sentence as published]. It is being viewed as a pilot star for tomorrow's European telecommunications systems, and British Aerospace anticipates further orders for satellites of its ilk once it is operational and performing satisfactorily.

Mission payloads for the demonstration satellite are:

1. 12 GHz direct broadcast payload. 2. Specialised services communications payload. 3. 20/30 GHz communications payload. 4. 12.5/20/30 GHz propagation payload. 5. Vibration sensor.

The four channel, 12/13/14 GHz specialised services communications payload will have applications in tele-education, news-gathering, remote printing and data distribution.

Besides providing communications services, Olympus 1 will also be used to carry out propogation experiments investigating the effect of atmospheric conditions, such as ice crystals in the stratosphere and cloud precipitation, on signals transmitted at the higher frequencies of 20/30 GHz. Once such transmission interference problems are better understood, work can begin on developing systems that incorporate countermeasures to overcome them. The 20/30 GHz communications payload provides two steerable spot beams. Two channels can operate through the two spot beams in a point-to-point mode or through one beam for local use. As well as conducting tests on transmission quality, plans for this payload would have it transmit to ships and aircraft, and relay experimental data from ESA's EUREKA space platform to its control center. In this role the payload acts as a precursor to ESA's planned data relay satellite.

Low Level of Support for Austrian Space Activities Criticized

36980197b Vienna DIE PRESSE in German 4 Apr 89 p 3

[Article by Dieter Bornemann: "Red-White-and-Red Bringing Up the Rear in European Space Travel: Austria's Government Spending on the Relevant Industry Is Disproportionate to Its Engineering Skills"]

[Text] "Navigare necesse est." This Latin saying is translated today by Georg Serentschy, director of the Austrian Space and Systems Technology GmbH (ORS), as "space travel is necessary." This is especially true for Austria, because compared to the rest of Europe, our country is "a dwarf" in the space market, according to Serentschy. In terms of per capita spending on space technology, Austria, with 190 million schillings (1987), is at the bottom of the list, with the exception of Iceland.

The world market comes to a total of 800 billion schillings, which corresponds to about half of all the goods and services produced in Austria, or a stack of 1,000-schilling notes that is 64 kilometers high. Even the European market—40 billion schillings and an annual growth rate of seven percent—seems modest in comparison.

Despite the low level of financial outlay, Austria can still claim international success: ORS, a subsidiary of the OeIAG group and of Dornier, itself a subsidiary of Daimler-Benz, has recently completed the sun shield for the European Space Agency (ESA) research satellite, valued at four billion schillings.

This shield protects the satellite from sunlight, and has affixed solar cells for generating energy. Despite a surface area of 15 square meters, the Austrian product weighs only 42 kilograms, due to a special honeycomb design with aluminum parts. The ISO satellite is due to be put into orbit with an Ariane 4 booster rocket in 1993, for studies on the infrared wave range.

Minister for Science & Research Hans Tuppy has cause to celebrate as well. For the incredibly cheap price of 85 million schillings for one ticket, an Austrian will be flying into space together with Soviet cosmonauts. The selection process for candidates is already in full swing. The 200 applicants will finally be narrowed down to two, who will travel to the USSR. One of them will then be the first Austrian to view the earth from space and to look after Austrian experiments.

A cost of 160 million schillings is anticipated for the entire project. Of this total, 75 million applies to scientific experiments. "Much to little to conduct economically significant research," says one scientist.

ESA spending in 1987 amounted to the equivalent of 20 billion schillings. Over the course of the 7 years until 1993, this will double to 40 billion. Still, the European market continues to drag along behind developments in Asia. Japan, India and China are in the lead, and 15,000 people are employed by the space industry in Indonesia alone. Rapidly-developing countries see space as the key to further economic development.

In contrast, many specialists feel that Austria is too attached to traditional forms of industry, and is paying large amounts of money each year to preserve them.

The aerospace industry in the FRG has experienced above-average growth over the past two decades. According to a study by the German Institute for Economic Research (DIW) in Berlin, no branch of industry in the FRG experienced a higher rate of growth in terms of employment figures between 1970 to 1987. During that period, employment increased from 61,100 to 86,600.

Sales by the German aerospace industry rose from the equivalent of 20 billion schillings in 1970 to 150 billion in 1987. The increase in sales per employee was impressive: from 329,000 to nearly 1.7 million schillings. The expenditure on research and development, which is extraordinarily high in this branch of industry, came to 24.6 billion schillings in the FRG in 1987, representing an increase of more than 70 percent since 1980. Austrian researchers can only dream about these growth rates.

In an international comparison as well, Austria's financial outlay on the space industry is tiny. Whereas the U.S. government spends the equivalent of 1,000 schillings per citizen on civil aerospace, the figure for Europe is clearly lower, 100 schillings on the average. In comparison, the 25 schillings for each Austrian is a mere pittance. After all, in Switzerland it is 79 schillings, and space travel is "worth" 94 schillings to each Swede.

But other indicators show Austria's rejection of aviation only too clearly: Austria has a share of 2.4 percent of the total European gross domestic product (GDP), while Austria's share in the ESA program is only 0.9 percent.

While only several years ago Italy was very comparable to Austria in the space industry, our southern neighbors have clearly surpassed us in the last 3 years. Serentschy sees an explanation for the "northern Italian economic miracle" in an effective subsidy policy and a high level of acceptance of new technologies among both the population and the money-dispensing politicians. The growth of once-small companies has caused an economic maelstrom throughout all of northern Italy.

According to Serentschy, a similar development in Austria is inconceivable for the time being. "In Austria's train, there are too few in the locomotive and too many in the brakeman's caboose."

GIFAS President Views French Aerospace Industry

AN890152 Paris LE BULLETIN DU GIFAS in English 23 Mar 89 pp 1-8

[Summary of remarks by Jacques-Andre Larpent, president of the French Aeronautics and Space Industries Group (GIFAS), at a news conference in Paris on 7 March 1989: "The French Aerospace Industry as of 31 December 1988"]

[Text] On 7 March 1989, Mr. Jacques-Andre Larpent, president of GIFAS (Groupement des Industries Francaises Aeronautiques et Spatiales) held a press conference in Paris during which he made a general report on the 1988 situation of the French aeronautical and space industry. The GIFAS president was accompanied by representatives of the major firms: Aerospatiale, represented by its delegate general manager Yves Michot; Avions Marcel Dassault-Breguet Aviation (AMD/BA), represented by its chairman-chief executive, Serge Dassault; SNECMA, represented by its chairman-chief executive, General Bernard Capillon; Matra, represented by its assistant general manager, Emile Durand; SEP, represented by its chairman-chief executive, Jean Sollier; Groupe des Equipements of GIFAS, represented by its vice president, Alain Guigue.

A certain number of developments are beginning to modify the great balances profoundly, whether these are strategic, political or economic. However, the French aerospace industry is made up of approximately 200 companies, including 5 major primary contractors (Aerospatiale, AMD/BA, SNECMA, Matra, Thomson/BEA), and has shown no significant change.

The industry achieved good results in 1988, but like the rest of Europe, it is going through a transition period. What will the French aerospace industry be like in 1993 when the European market opens up?

French Aerospace Industry Results in 1988

In 1988, the turnover of the French aerospace industry increased to 83.9 billion francs, that is, an 8 percent progression in volume and 11 percent in value (75.4 billion francs in 1987). This growth is superior to that for the previous financial year.

However, these results are characterized by a slight decline in the military sector, evaluated at 57 percent (59 percent in 1987) of the turnover. This shift is due to the decline in export deliveries as well as in deliveries in France.

This evolution can equally be seen for orders. The civil export orders have shown a very strong progression, since they represent 67 percent of the total exports (57 percent in 1987). Total orders amount to 120.5 billion francs, of which 70.5 billion francs is for exports (i.e. 58 percent). The total orders show a very significant increase of about 34 percent compared to 1987; this increase is due essentially to exports (up 48 percent), while the French orders have increased by only 19 percent.

The level of deliveries as well as the level of orders [as published]. But, when these figures are analyzed, great differences appear in the various product sectors, according to whether they are in the civil or military markets.

The Civilian Market

The 1988 civilian market has been marked by the 9 percent high growth rate of air traffic. This year has been quite remarkable for the world's three main manufacturers: Boeing, Airbus and MDD, since the airline companies have ordered 934 wide-bodied aircraft. In order to keep up with the growth in air transport, the airline companies are all placing large orders for new aircraft, and buy second-hand to bridge the gap.

In 1988, Airbus received 167 orders and commitments, of which 116 were for the A320 (51 orders for the A310 and A300-600, A340 and A330 wide-bodied aircraft). This brings to 1000 the number of companies' orders received by the Airbus Industrie consortium (Aerospatiale, MBB, British Aerospace, CASA) from 77 companies.

Due to this strong commercial breakthrough, Airbus Industrie forecasts the production rate in 1989: 107 Airbuses to be delivered (against 61 in 1988), 134 in 1990... 200 in 1994. The present rhythm of 4 aircraft per month should double by June 1990.

Over the coming years, civil transport should have an exponential growth rate. However, massive entry into services of the 110/160 seaters and the present overloading of airports lead the airline companies to revise their future investments, moving towards the wide-bodied aircraft (A310, A300-600 or the new A330). If this evolution were sudden, it could worry certain engine manufacturers and/or equipment manufacturers.

General aviation has performed equally well: The commuter and business aircraft market has allowed the ATR Group (Aerospatiale-Aeritalia) to sell 70 ATR 42 and 72s, and allowed AMD/BA to sell 42 Falcons.

In the same way, the civil helicopter market has received a breath of optimism.

In 1988, Aerospatiale, through its American subsidiary "Aerospatiale Helicopter Corporation," registered 280 orders (against 188 in 1987), and has moved into the number one position in the North American market for helicopters delivered and brought into service for private customers.

It must be noted that there has been a very strong increase in this sector in Asia and Australia.

The Military Market

The military domain is considerably influenced by the international, strategic and economic contexts.

The position held, since the sixties, by the French aerospace industry is due to its military sector. But the French armament industry has, over the last three to five years, been faced with three types of difficulty:

—The new structure of the world market: If world defence spending has reached around 1,000 billion dollars, that for equipment is approximately 250 billion dollars, and today's level of international exchanges is only 30 to 40 billion per year.

This is explained by different factors: the drying up of petrodollars, the end of some conflicts, the enormous economic and financial imbalance, but also the rise of new supplier countries (South Africa, Brazil, India...) who have vigorous sales in the area of less sophisticated hardware (training aircraft, light-armoured vehicles).

However, in spite of the contraction and hazards of the military market, France has remained in 3rd place in the world market.

But the competition is tougher and our export results, particularly in the aeronautical field, show some weaknesses.

The industrialized countries are very active in the market: The United States benefits from its political impact and SMF credits; Great Britain, under the impetus given by its prime minister, is showing great vigour; West Germany and Japan, longtime absent, are obtaining significant results in some sectors.

—The use of increasingly sophisticated technology: At the end of the seventies, there was the massive introduction of new technology in conventional armaments. This evolution has generated a spectacular increase in research & development in armament production.

—Added to the considerable increase in study, test and production costs, it results from this that the middle-sized powers are no longer able to engage in large-scale armament programs on their own.

The preservation of our technological potential means sharing costs of research, development and industrialization with other partners.

As regards France, the airframe, engine, missile and equipment manufacturers are subject to the defence budget of the French state and the law covering the 1987-1991 military program. This law has meant the launching of numerous programs, but it seems that the economic conditions (increase in GDP, additional material costs...) will not allow the completion of all the considered programs.

However, the period 1988-1989 is an important point for the replacement of military equipment, carrier or missile, and will be marked by the revision of the military program law.

Space

It is a high growth area which today makes up around 8 percent of the French aerospace industry's turnover, double its level of four years ago. Three major programe were launched in 1987: Ariane 5, Columbus, Hermes.

The 1987-1991 military program law plans two programs: Helios and Syracuse for 10.3 billion francs (in 1987 French currency).

The French Space Agency (CNES) saw its budget increased by 19 percent between 1988 and 1989. Even if Arianespace is the dawn of commercial maturity, this sector faces numerous scientific, industrial and economic challenges.

French Aerospace Industry in Europe

The European Act signed by the member countries of the EEC in 1986 should assure a total liberty of the circulation of goods, persons, services and capital smoothing out technical (harmonization of norms), physical (customs), tax (VAT and indirect taxes), and financial difficulties and giving access to national markets. In spite of the specificities inherent in the aerospace industry, this situation should drastically change a number of economic and financial structures as well as the behaviour of private and public companies.

We will only discuss two elements of the new situation:

—The problem of establishing a military position within the context of a common European base for the European aerospace industry.

The Treaty of Rome setting up the EEC eliminates, in Article 223, a list of war materials. In effect, Article 223 authorizes each member state "to take the measures that it judges necessary for its security, insofar as they concern arms, munitions and war material production as well as the sale of these materials."

The major part of European armament industries have also civil activities. The progress generated by the accomplishment of an internal European market, such as has been shown by various Community reports and studies, will lead the companies to want to profit from the advantages that such a market presents for the buying of armaments.

Although there is no link between the EEC and the military institutions such as the IEPG (Independent European Programs Group), which includes all the European NATO countries, the national armament directors are trying to favour the emergence of a European armament market by different initiatives which will, no doubt, soon have an impact on the French aerospace industry:

—Franco-British cross purchase agreement;—Elaboration of common research projects;—Progressive harmonization of the publication of calls to tender for the public defence markets.

The European perspective provokes strategic reactions taking the form of an accentuation of cooperation and of restructurations.

Cooperation

This type of operation can favour exploitation of new opportunities in the face of a saturated home market.

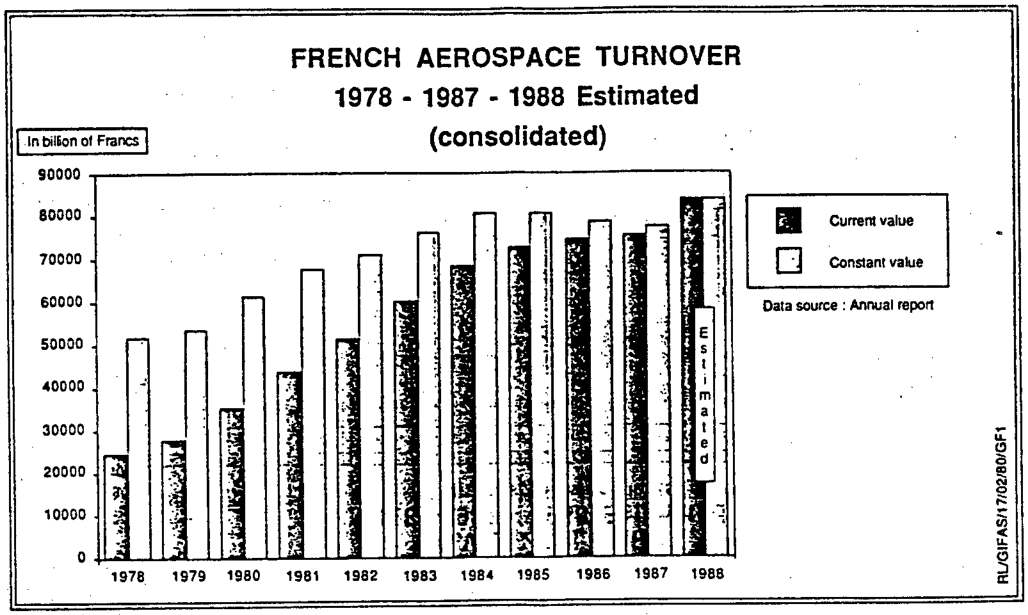
For a long time (since the sixties) the French aerospace industry has created numerous examples of European cooperation and has generated durable structures (Airbus, Euromissile, Arianespace...). If civil cooperation is quite healthy, cooperation in the military domain is encountering difficulties (cf. the latest negotiations: combat aircraft, Franco-German helicopter).

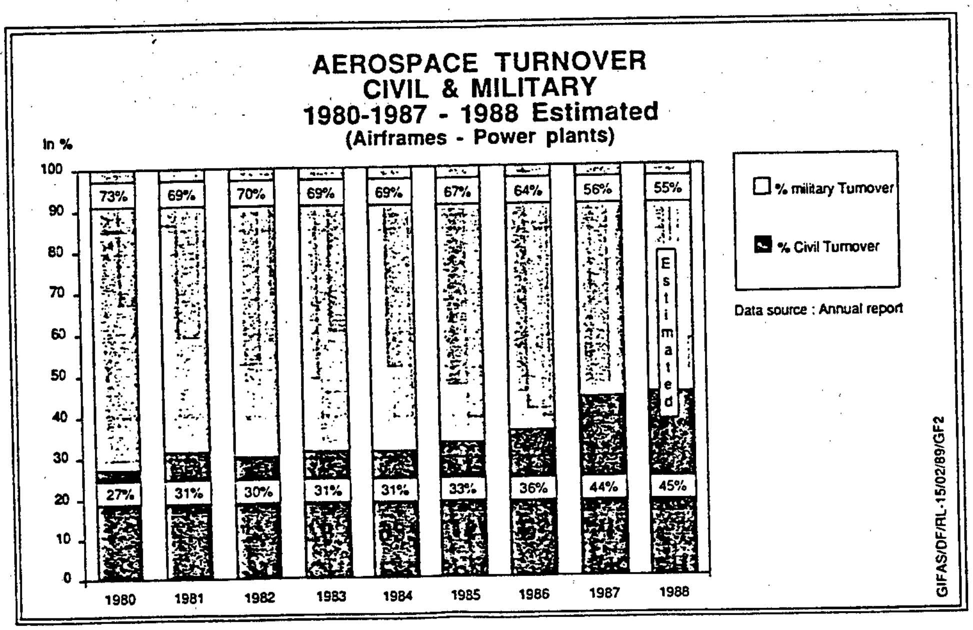
As regards armament, the cooperation has become difficult. Apart from the American attraction, the principal companies have been carrying out for some time, in Europe, a fierce struggle to gain European supremacy in the field of armament. The transatlantic cooperation comes up against the protectionist tendencies of Congress (American Trade Act), and the coherence of a European pillar stumbles because of the contradictory demands of the General Staff.

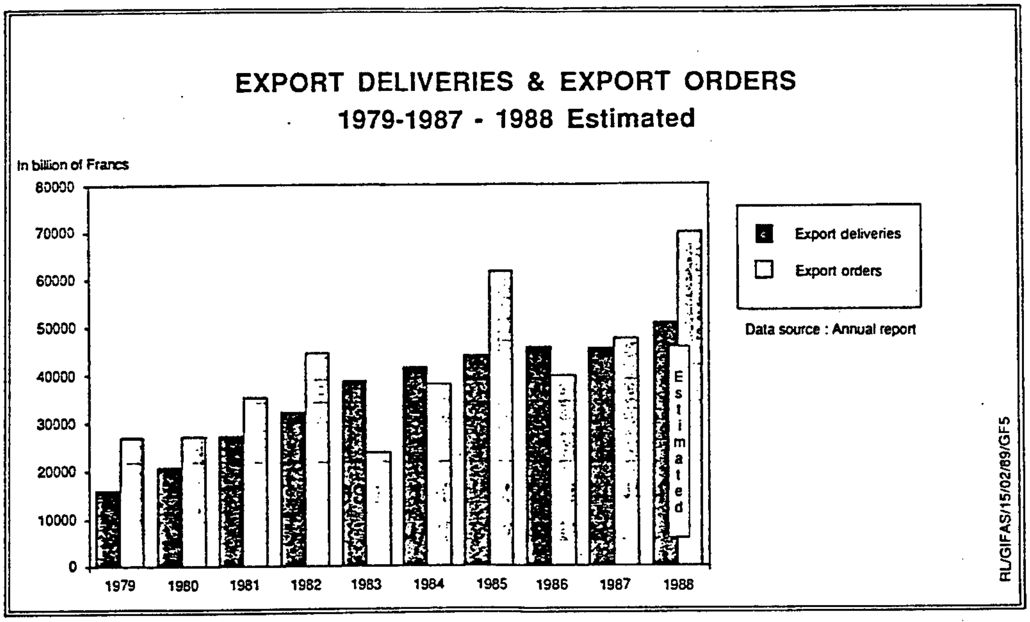
Restructurations

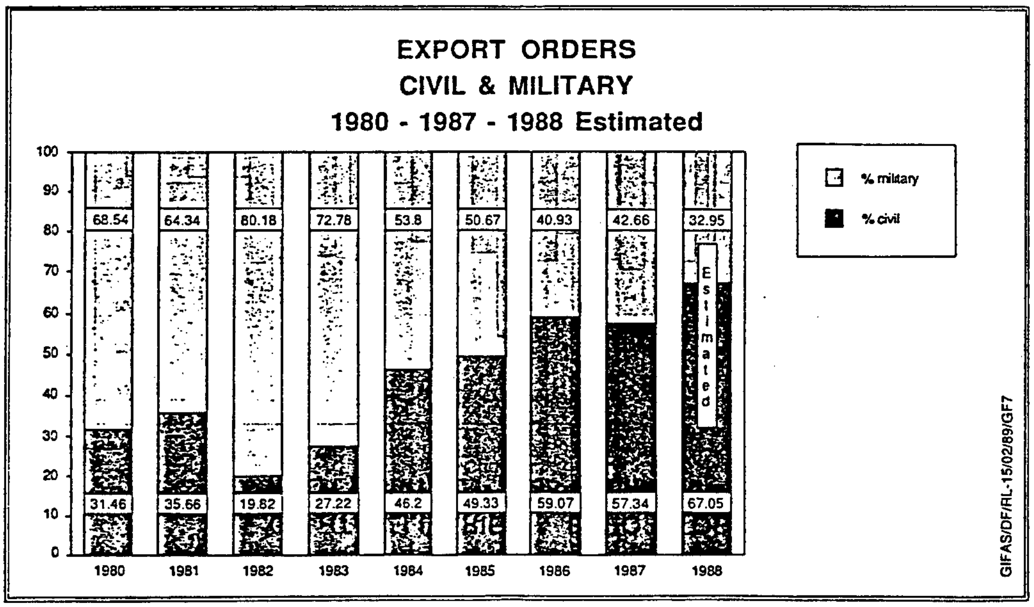
At the internal level, they consist of operations of centralization and rationalization. At the external level, they take the form of partial takeovers, takeovers and mergers.

The building up of a wider market seems to call for the restructuring of the principal European companies. But, looking at the different restructurations of the European armament companies, which have recently been in the headlines, the goal usually sought is the growth of national entities in order to preserve such-and-such a sovereignty. One can almost see a regression of the European idea in this.









FACTORY AUTOMATION, ROBOTICS

FRG Firms Develop CIM Training Programs

36980197a Duesseldorf HANDELSBLATT (KARRIERE supplement) in German 7 Apr 89 pp 1-2

[Text] It is still science fiction to imagine that one day robots will attend the industrial fair in Hanover to find out about the latest trends in development of the computerized "factory of the future"; it is humans who are attracted to industrial automation, which this year is the focus of the fair. These humans are primarily technical specialists who also feel a professional draw to the event.

In recent times, it has become increasingly clear—and this is being correspondingly articulated in and around this year's Hanover fair—that computer-integrated manufacturing (CIM, meaning the linking of all computer-aided areas of production) is not possible without the highly skilled specialist, and this is true in planning, development and implementation, as well as in the operation of ultramodern systems.

But CIM specialists do not come straight out of the technical universities and colleges, complains Lutz Greinert, head of systems analysis and coordination production for Volkswagen AG in Wolfsburg. Mechanical engineers who have knowledge of data processing systems in addition to classical engineering are rare, and have generally acquired this integrated know-how on the job and with the help of (usually spare-time) continuing education training.

The need for CIM training can be seen at all levels of the hierarchy, says Rolf Hahn, head of the information and training division of the production automation and automation systems department for Siemens in Erlangen: "Introducing CIM is the main thing. For us, each plant is itself responsible for developing and implementing automated production lines. The plant manager does find in our production planning technology division an experienced partner that will convert his ideas into the corresponding hardware and software and get them up and running, and he is also supported by the central technology department, in which fundamental questions about automation can be explained, but he himself makes decisions and must have the relevant know-how at his disposal."

Still, the plant manager is not working entirely alone; rather, he and experts from various organizational units in his plant constitute a team. These areas can include design, production preparation, quality assurance, organization and data processing, but also finance. As a project group, these people work together to prepare the planning, development and implementation of the production line. And even though Siemens is always happy to attract a CIM specialist from outside the company—at a correspondingly high salary level, or so they say—it is more customary to develop CIM teams from the next generation of specialists within the company.

Hahn: "In order to ensure that we have an adequately qualified personnel for CIM applications, we sent around 380 mid-level executives to a 6-week CIM seminar around 3 or 4 years ago, where all the relevant themes, from the technology to the social domain, were covered." Today, there are three levels of continuing education:

- CIM college for upper-level management, thus the plant managers who want to be informed about CIM strategies and concepts
- CIM forum for mid-level management
- A broad offering of courses for skilled workers who are to be trained as system managers

The system managers are ultimately the operators of the modern factories if the growth in automation also means that additional higher-level positions will be created for engineers.

The situation is similar at the Volkswagen plants, where besides the control station personnel, so-called coordinators are deployed: production engineers with a thorough knowledge of the factory equipped with new manufacturing technology who can intervene in problem situations, since even the smallest technical defect can paralyze the entire network of production and cause disproportionately high costs. Until such production facilities exist at VW, the planning department and the organization and data processing department—thus, mechanical engineers, computer scientists and physicists—must work together as a team. "To this end, the planning department needs, among other things, fully trained mechanical engineers, who should also be one-third systems analyst." Since colleges do not offer an adequate course of studies for this, engineers with computer skills at VW are being developed into so-called "system engineers." Lutz Greinert: "This is taking place primarily on the job, in the systems analysis division, but also in continuing education programs for the specially created 'system engineers club,' which meets regularly."

Thus, hundreds of CIM specialists are accumulating in the major companies, making these conglomerates the envy of medium-sized industry. But the latter must keep up, stresses Hermann Kuehnle, head of the CIM Technology Transfer Center at the Fraunhofer Institute for Production Technology and Automation (IPA) in Stuttgart. Ensuring their future is only possible with CIM in accordance with the slogan, "better, cheaper, faster and more flexible than the big guys." Because CIM is not bought off the rack, but must always be adapted to special conditions, the medium-sized companies too need specialists who can formulate the company's needs during the planning phase and preliminary discussion with the manufacturers. Consultants are only of limited assistance here, even if a noticeably larger number of these services are becoming available (thus, SCS in Hamburg opened its CIM center in January, with 100 positions). Medium-sized companies must therefore invest in CIM continuing education, just like the big companies, because the material is too difficult for employees to make investment decisions in the CIM area without deep-rooted know-how. Once companies send out signals that they want to win over and retrain engineers for such tasks, their offer will be just as attractive and alluring as those by large companies, who despite strong competition are able to win over and develop an adequate number of such specialists "because of the attractiveness of these jobs" (Greinert).

MICROELECTRONICS

Results of ESPRIT Projects on Wafer-Scale, 3-D Integration

AN890110 Paris ELECTRONIQUE HEBDO in French 16 Feb 89 p 15

[Article by Francoise Grosvalet: "Wafer-Scale and 3-D Integration: Europe Makes Up for Lost Time"]

[Text] The first results obtained by Europe in the field of wafer-scale and 3-D integration, the most advanced sectors in microelectronics, augur well for the future.

At the Euro-ASIC 89 exhibition which took place in Grenoble at the end of January, two French laboratories demonstrated circuits which, although they have no direct connection with ASICs [application-specific integrated circuits], are interesting in more than one respect. One is a wafer-scale integrated circuit developed by the CSI laboratory at the National Polytechnic Institute of Grenoble (INPG) as part of a project within the European Strategic Program for R&D in Information Technologies (ESPRIT) project, and the other is a 3-D mezzanine gate array developed by SGS-Thomson in cooperation with the Laboratory for Electronics and Computer Technology (LETI), also as part of an ESPRIT project. Both are representative of the results obtained in Europe in fields that are at the forefront of developments in microelectronics. Europe can be proud of these results, which are comparable to the best work being done in Japan or the United States in this sector.

The first ESPRIT project, dubbed European Large SIMD [Single Instruction, Multiple Data] Array (ELSA), is in fact headed by the British Telecom research laboratories. Its aim is to create an image processor on a wafer measuring 150 mm in diameter, capable of processing 10 billion instructions per second. The principle is based on the integration, on a single wafer, of a network of 128 x 128 elementary processors in an SIMD-type architecture. Each processor can thus communicate with its four immediate neighbors. The elementary processors are grouped in matrices of 12 x 9 columns, one column being redundant, the circuits thus formed being interconnected on the wafer via peripheral switches. The first wafer-scale circuit of this type has just left SGS-Thomson production lines. It integrates only 96 circuits of the type described above, for a total of 9,126 elementary processors on a wafer 100 mm in diameter in 1.2 μm complementary metal oxide semiconductor (CMOS) technology, whereas the aim is to put 144 circuits on a wafer 150 mm in diameter. This first wafer-scale integration circuit can therefore be considered the largest and most complex integrated circuit (more than 11.5 million transistors) ever achieved.

Each of the elementary processors is composed of six multiplexers, five latches, one adder-subtractor, and two 64-bit random-access memories (RAMs). The 1-bit arithmetic and logic unit, designed to be very simple and for the most general use possible, is connectable in four directions (east, west, north, and south). One elementary processor occupies a surface area of 0.25 mm^2. It is optimized to carry out additions and multiplications in a minimum number of clock cycles at 30 MHz. With a view to this, the local memory has a read/change/write architecture configured in two independently addressable blocks of 64 bits. An 8-bit addition can thus be carried out in 9 clock cycles.

Each elementary processor (EP) has an input and output line on each side; these lines are connected to the four neighboring EPs and allow communication among them during processing. The peripheral elements in a network of 12 x 8 EPs are connected to four 8-bit two-way buses, which allow the circuits to be interconnected in the same way. In fact, the basic circuit integrates 12 x 9 EP columns on a chip measuring 6 x 6 mm, 8 processors being used per row. The presence of redundant elements makes it possible to improve overall performance, as a defective EP can easily be disconnected and bypassed. In addition to this fault tolerance within the circuit, a network of switches makes it possible to isolate weak circuits and thus build a 2-D network which only uses good circuits. The network of switches consists of a double row of programmable software switches surrounding the circuit. Eight switches are located at the periphery of each circuit, each being configurable in four positions. The switches are put into their final position by floating-grid field-effect transistors (FETs) or laser fuses once all tests have been carried out and the working elements (circuits, connections, and switches) located.

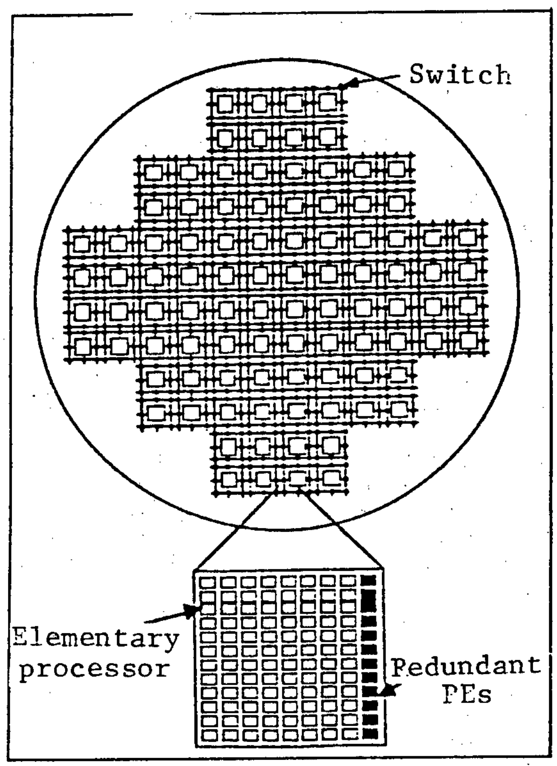
Programming is done progressively so as to be able to control the whole network of switches. The first wafer is currently being tested in Grenoble, but the effectiveness of the switches has already been proved, as has that of the elementary circuits of 8 x 8 elementary processors. The first applications of this type of circuit should be in the field of image processing, notably for avionics and telecommunications.

In another field, the intelligent power gate array developed by SGS-Thomson is a first step toward the creation of true three-dimensional structures. A mezzanine-type approach was first chosen to show the feasibility of integrating, on the same chip, a gate array on recrystallized oxide and a MOS power element. The two structures have been staggered laterally as opposed to true 3-D integration, in order to: avoid the use of vertical interconnections of refractory materials, which limit current-bearing possibilities; limit the number of masking stages; and facilitate testing.

The mezzanine structure was developed, as part of the ESPRIT project on materials for 3-D integration, by SGS-Thomson in cooperation with the National Maritime Research Center (NMRC) for the design and testing stages; LETI, the National Center for Telecommunications Studies (CNET), and the Cambridge University for the silicon-on-insulator (SOI) recrystallization; the General Electric Company (GEC), NMRC, and LETI for the technological stages. It combines on a single chip 18 MOS power cells, 4 mm wide, in 3 μm double-diffused metal oxide semiconductor (DMOS) technology and a gate array network of 1,000 transistors in 3 μm CMOS technology. The MOS power cells are initially manufactured in the heart of the material; a layer of oxide 5,000 angstrom thick is then deposited over the whole chip and half of it is recrystallized using the method known as ZMR (zone remelting using laser or electronic beams). It is on this layer that the gate array network is manufactured; it comprises 432 logic cells, 18 input cells, 9 input/output cells, and 18 level shifters to allow interfacing with the power element. The final metallization is carried out in a single stage on both parts.

A control circuit for a 50 V/1 A stepping motor using 340 logic cells and 16 DMOS power cells has been manufactured on this 3.2 x 5.6 mm structure and has proved entirely functional. A wide variety of other smart power circuits can be created in the same way and can offer advantages in comparison with current hybrid structures (in terms of speed, power consumption, and reliability) or even with traditional monolithic structures, which are far more complicated to manufacture and limited in terms of performance by their technology.

Figure: Wafer Architecture



The elementary processors are grouped in matrices of 12 x 9 columns, one of which is redundant. Ninety-six of these matrices have been put on a wafer 100 mm in diameter and are interconnected by a network of programmable switches to produce the world's most powerful image processor.

French Firm Develops Real-Time Vocal Interface

AN890111 Paris ELECTRONIQUE HEBDO in French 16 Feb 89 p 18

[Article by Christine Serou: "Vecsys or Voice Command for Your Micro"]

[Text] There is a personal computer in France today which can analyze up to 500 concatenated words from a single speaker in real time.

A new man-machine communication device is on the horizon. Tomorrow's computer scientist will no longer have to type on a keyboard, but will be able to tell his computer which text to display on the screen or which command to send to dedicated machines; voice recognition will occur at normal talking speed. Even those who speak quickly will be able to be recognized, provided, of course, that they articulate properly. This is not taking place in the cockpit of a fighter aircraft but in the offices of the Vecsys company. Of course, the firm has not yet created the perfect vocal interface that would render the keyboard obsolete, but its product—three small cards—will allow a microcomputer (a PC for the moment) to understand 600 concatenated words (i.e., at normal talking speed) pronounced by a specific individual. In addition, the micro can understand 5,000 isolated words (i.e., a word spoken between two pauses) pronounced by one person, or 500 isolated words pronounced by different types of individuals and linguistic groups (man, woman, or child; or English, German, French, etc.), or, lastly, 50 multispeaker words. The response time is less than 500 ms, however long the sentence. The circuit that drives these cards is called a micro-PCD [Dynamic Comparison Processor]. It has been developed by three thoroughly French companies: the Data Processing Laboratory for Mechanics and Engineering Sciences (LIMSI), a group of research workers at the National Center for Scientific Research (CNRS), and a cooperative effort by Vecsys and Bull.

This processor has an output of 10 million instructions per second at 20 MHz (300,000 to 500,000 equations per second), i.e., 130 times more processing power than the Intel 80188 functioning at 10 MHz and 15 times more than a signal processor such as the TMS320C25 at 40 MHz.

Three Little Cards

This voice recognition processing power means that more data can be managed and that the vocabulary used in applications can be enlarged to more than just a few dozen words. The computer will recognize the spoken words by a process of dynamic comparison; i.e., with the aid of integrated algorithms, it compares each new vocal element with a previously established database. The more powerful it is, the faster it works, and its reference codes can be increased accordingly.

The three Vecsys cards are called Datavox. The first is located in a box outside the computer. It includes 16-bit analog/digital and digital/analog convertors, 16-bit compatible antinoise filters, and the necessary connections for all types of audio equipment (headphones, microphones, etc.). The box is connected to a signal processing card by an optocoupler (in stereo mode, two boxes must be connected to the card). The two other cards, for signal processing and pattern recognition (containing the MPCD), are connected directly to the PC bus. They communicate with each other either through this bus or through a strip linking them directly. The PC can thus perform voice recognition as a background task. The Datavox system uses Amadeus software. To implement it, the user does not have to write any additional software, since an application configuration software package makes it possible to define the vocabulary, its syntax, and the character sequences corresponding to the spoken words or strings of words.

Vecsys has been interested in speech technologies for a long time. LIMSI is responsible for the basic research, and the company develops the industrial or military applications. In 1980 the company designed the first isolated-word recognition card made in France, based on the MOISE [isolated word] algorithm, the RMI88. In 1982, along with Crouzet, it equipped the first French military aircraft with such a system. Today it is working on the Rafale program.

Although voice recognition is still its major product, the company has more than one string to its bow. Its product inventory includes speech synthesis systems which are used in the Lyon subway system and in control systems for industry (portable and on-board computers).

Interview with FRG Expert on EC Competitiveness

36980194 Hamburg DER SPIEGEL in German 24 Apr 89 pp 118-130

[Interview with Ingolf Ruge of the Technical University of Munich and Fraunhofer Institute for Solid-State Technology, by Rolf Diekhof and Michael Schmidt-Klingenberg: "'What Is Important Is That We Not Leave Ourselves Open to Extortion': Prof Ingolf Ruge on Billion-Mark Subsidies for Microelectronics and European Prospects"; first paragraph is boxed introduction]

[Text] Ingolf Ruge is a lecturer in the Department of Integrated Circuits of the Technical University of Munich, and managing director of the Fraunhofer Institute for Solid-State Technology. For some 20 years, he has been an advisor to the Federal Ministry for Research & Technology and has been used by the EC Council of Ministers as an expert for EC electronics programs. As a scientist, Ruge, 54, was involved in the development of ion implantation—the basic technology for producing integrated circuits.

DER SPIEGEL: Mr Ruge, Europe's electronics conglomerates, led by Siemens and Philips, are asking Bonn and Brussels for billions in subsidies for an electronics program. The production of new superchips is supposed to put an end to the hegemony of the Japanese multinationals in the area of chip production. Should the state once again throw away billions on a senseless project?

Ruge: No, certainly not. Siemens, Philips, the French-Italian firm SGS-Thomson (ST) and around 20 smaller companies are themselves willing to invest DM 3 billion on the so-called JESSI (Joint European Submicron Silicon Initiative) program. Brussels is adding a projected DM 1.9 billion, and another DM 3 billion should be put forward by the governments of the three nations involved. This money is clearly well-invested, and the main thing is that it should be invested right now. Otherwise it will be too late.

DER SPIEGEL: The EC's first electronics program also cost billions, with scarcely any return. Why are you so optimistic now?

Ruge: In the past, Europe's microelectronics specialists—the technicians of our future—have met each other only haphazardly, in the United States. The earlier EC electronics project, the so-called ESPRIT program, for the first time brought Europeans together in Europe, and helped dismantle obstacles and intellectual barriers. I feel that it was a major step and a major success.

DER SPIEGEL: Was that step not a little overpriced, to the tune of DM 3 billion?

Ruge: That money did in fact generate some technical advances; the focus of the project was fundamental research. Even the much-maligned megachip project...

DER SPIEGEL: ... You mean the cooperation between Siemens and Philips in producing a chip that can store a million bits...

Ruge: ... yes, even that project was a success. In 1983-84, the Europeans began their race to catch up with the Japanese. We won that race. No one in the industry imagined that Siemens and Philips would cooperate so closely—with an exchange of personnel, reciprocal visits, equipment loans, even with an airlift between Munich and Eindhoven. At the time, this was unprecedented in Europe, it was surprising.

DER SPIEGEL: Today, Europe remains so far behind Japan and the United States in electronics that it is scarcely possible any more to catch up. Can you name one high tech sector where the Europeans are actually in the lead?

Ruge: I can only say one thing about that. We have to endure a couple of difficult periods. The first major experience was that we succeeded in the megachip project.

DER SPIEGEL: What was so great about that?

Ruge: No one believed that it was possible within 4 years to so quickly improve the situation, which at Siemens and Philips unfortunately was not very good. Today, a broad base has been created. In Europe, we have the first submicron technology—the circuits positioned next to each other on the chip are less than one-thousandth of a millimeter wide. And we are mastering this technology, in mass production as well.

DER SPIEGEL: This foundation is not worth much if investments of around DM 8 billion are now needed once again. Does the new superchip—64 million bits stored on a silicon chip the size of a fingernail—really ensure Europe a leading role in future technology?

Ruge: That is the question. Will we ever have a chance to get to the top and stay at the top? The answer: No way! The Japanese are simply too far ahead and too well-organized. Their economic organization is too good; they have an entirely different corporate structure than we do. A conglomerate like Mitsubishi, with annual sales of DM 450 billion, is the largest company in the world. It is seven times as big as Siemens. Companies that big naturally have entirely different resources at their disposal. In addition, the state and the major corporations in Japan follow a standard policy with respect to all central projects. Thus, we can forget about catching up with or outdoing Nippon Incorporated. What is important is something else: that we remain independent. It is important that we—and I will go even one step further here—not leave ourselves open to extortion.

DER SPIEGEL: Then why is it necessary to reinvent everything? Why don't Germans simply buy their chips in Japan and North America?

Ruge: Germany is divided into two camps—those who are vehement advocates of a microelectronics program, and those who are vehemently opposed, who say that it is the biggest piece of nonsense of all time. Why, the opponents ask, should we give Siemens money? The innovations will be a bargain for us on the world market. This is what Helmut Lohr, ex-CEO of the telecommunications company SEL AG, has said, and Klaus Luft, head of Nixdorf, also thinks this. On the political scene, there is a certain liberal party that holds this view as well.

DER SPIEGEL: Only you and Siemens know better?

Ruge: I must be quite frank about this. The goal of the Japanese—and they do have a goal, they have goals for everything—is a world monopoly on chips. They have even announced this publicly, and they are acting with this in mind: About a year ago, all Japanese chip manufacturers suddenly cut back on production, shooting prices way up. This monopolistic policy is currently costing companies like Nixdorf tens of millions of Deutsche marks.

DER SPIEGEL: And you see this monopoly as a threat?

Ruge: Yes, because with the monopoly on chips, the Japanese have access to all modern technologies. They have control over what will be the most important economic asset in the year 2000. In the future, chips will be the definitive raw material, not crude oil. Name me one piece of equipment that is part of our daily lives that does not contain chips. And this is really just getting started right now. Solving environmental problems, saving energy, modernizing production and information technology are the central tasks that we face in the years ahead, and they can only be resolved using high-quality electronics. It is impossible without it. If the Japanese control microelectronics, then eventually, of course, they can dictate technology to world-class companies like BMW. Do you want that?

DER SPIEGEL: The division of labor is an old principle, and perhaps there are areas in which Europeans are able to produce more intelligent and better products than the Japanese.

Ruge: It simply won't do for us in Europe to throw ourselves into sectors like chemistry and software, in the hopes that the world will continue to function according to a division of labor. I think that it is very dangerous to abandon production of the very product that is critical to all the objects of our daily life and of our professional surroundings. Do that with something else, but not with chips. And development is proceeding further. Miniaturization will mean that entire computer systems can be placed on a single chip. Whoever fails to keep up with this super-miniaturization technology is giving up on the central element of a new technology, and is giving up on being a leading economic power.

DER SPIEGEL: With microprocessors, which perform entire calculation sequences and are no less important, Europe and Japan are entirely dependent on the Americans. Does this not bother you?

Ruge: Right. With microprocessors, the entire world depends on three American companies, Intel, Motorola, and Texas Instruments. But that situation will be changing soon. In Japan, there is a major project under way—it is called Tron—with state funding and the involvement of all the powerful companies. The Japanese are saying, "No more dependency on the Americans, we'll build our own processors." It disturbs the pride and self-image of the Japanese to be dependent on someone else.

DER SPIEGEL: In your opinion the Japanese are doing exactly the right thing here?

Ruge: I think that the Japanese are smarter than we might have thought. Once the Japanese have become an economic power that can no longer be shaken by anything, they will start pursuing a global policy in a big way—a global policy to their own liking. I think that the Japanese are in principle a peaceful nation, but I have noticed that they make use of every opportunity to bring about their concept of themselves as a dominant economic power.

DER SPIEGEL: The Europeans started too late; they have just mastered megachip technology and are still far behind. Isn't it hopeless?

Ruge: Because things are as they are, we need programs in Germany and all over Europe that are broadly financed and that develop little by little into major dimensions. The money required for the 64-megabit chips, which again represent a new technology, exceed the financing capabilities of companies like Siemens and Philips.

DER SPIEGEL: Toshiba has announced that the new superchip, with 64 million bits, will be ready in the mid-1990s. Will the Europeans be ready by then too?

Ruge: Siemens or Philips alone will not make it. However, I see the possibility that we will not be dependent, will not be subject to extortion.

DER SPIEGEL: Why are Europeans so far behind, anyway?

Ruge: The bad thing is that the many institutes, the many university departments and technical schools that we have in Germany are contributing only modestly to the tools that we need.

DER SPIEGEL: What sort of tools?

Ruge: An example. To this day, the Americans, and more specifically Stanford University in Silicon Valley, have a worldwide monopoly on a so-called tool for process simulation. And they do not intend to give it away.

DER SPIEGEL: Where is process simulation used?

Ruge: It is used to develop megachips, to test production steps on the computer. Today, we no longer have the time to try out individual steps in practice. This is no longer possible because the next generation of chips is being developed now every 3 to 4 years.

DER SPIEGEL: And what are the Japanese doing, since they too are not getting the critical tool?

Ruge: The Japanese noticed 4 or 5 years ago that Stanford had the worldwide monopoly, and they took action. They began to create their own simulation programs. Today, theirs are running smoothly.

DER SPIEGEL: Every point that we cover makes it only more unlikely that Europe will become independent in the microelectronics field. What is going wrong in this area?

Ruge: What we need is a broad front, the money from Siemens or Philips combined with the know-how of universities and institutes. JESSI is an attempt to do just that. But for that to happen, the German minister for Research & Technology would have to get around to standing up and saying, "I am offering a program to x number of institutes or university departments or groups of scientists in Germany." That would be very important, because Europe's JESSI is presently a big nothing. Right now, JESSI is only a piece of paper.

DER SPIEGEL: So more money for microelectronics?

Ruge: Not necessarily. I would simply like to see university and research groups become a little more aggressive and work with short-term goals, which can then be transferred to products relatively quickly.

DER SPIEGEL: How should the minister of Research & Technology achieve that?

Ruge: We need a national program that offers incentive for research groups. There is enough work, there is a great deal to be done on the theoretical side. After all, that's the great thing about microelectronics, that the major factories are not critical factors. There is also a very big demand for theoretical work.

DER SPIEGEL: You continually assume that Europeans have already caught up in megachip technology. But in reality, Siemens or Philips cannot produce any superchips without the special machines from Japan. How do you propose to change that?

Ruge: We're coming here to a very sore point. No one could have predicted that the Americans, who supplied the technological equipment to chip factories 2 or 3 years ago, would drop off the market as suppliers. Today, the American products, compared to the Japanese technological equipment, are no longer competitive in terms of quality. We have in actuality shifted from one dependency to another, if you will.

DER SPIEGEL: This concerns primarily lithography equipment for transferring the submicron structures onto the silicon chips. Is there no company in Europe that has mastered this technology?

Ruge: You'd have to look far and wide. We in Germany—at this institute, as a matter of fact—began developing X-ray lithography 13 years ago; because of its higher precision compared to present-day laser lithography, it has an even greater future in chip production. X-ray lithography was invented here. Later, my former vice president and student, Anton Heuberger, took it with him to Berlin, where he has made it into a genuine success.

DER SPIEGEL: That was not enough. The Japanese are currently in the lead in X-ray lithography as well.

Ruge: Now they're ahead. We had a lead on them for a long time. Here as well, structural weaknesses play a little bit of role. Three or four years ago, Siemens or the German minister for Research & Technology should have said, "OK, we have mastered it, now we are setting up a company to extend the lead achieved by scientists at the Fraunhofer institutes in Munich and most of all in Berlin." But that didn't happen.

DER SPIEGEL: You say that Europeans have begun to catch up. Does it not instead look as if they have lost ground?

Ruge: I cannot offer a very strong rebuttal to that view.

DER SPIEGEL: And things are not optimal with your source of hope, the JESSI project, either. It is coming along too late, the politicians are fighting about locations, Philips and Siemens are already considering going off on their own.

Ruge: I am the person who said for the first time that JESSI is still not optimal, and that did not make Mr Riesenhuber very happy.

DER SPIEGEL: Is that why you have never repeated it?

Ruge: I have not repeated it. I do not wish to recant, but perhaps I somewhat overestimated the amount of time needed to put these things into effect. In late December, a good, well thought-out book full of proposals was published, a book put together by various European experts over the course of a year. Now, the companies, the national governments and the EC authorities have to get together and reach a decision as soon as possible.

DER SPIEGEL: When should the new program get under way?

Ruge: Mr Riesenhuber and Brussels have just promised the first funding. In the meantime, industry is saying that something has to happen in the next 3 or 4 months or they will have to look around for other solutions.

DER SPIEGEL: Philips and Siemens would rather keep the Italians and French out. Why?

Ruge: That is a very natural objective. Look, it was first a sort of inventors' club. Siemens and Philips really carried out their joint megachip project at an incredible expense. Now they have advanced their know-how so far that the products are being introduced on the market. In that situation, would you then invite other people in and say, "Come on along and take a look at how we do it"?

DER SPIEGEL: Will Siemens and Philips continue in the future to produce their own equipment for chip production?

Ruge: No, that is a different club that we are just now putting together in desperation. And things are looking very bleak, I must say, unfortunately.

DER SPIEGEL: Because there are so few people involved?

Ruge: There is scarcely anyone at all. They must always consider that Europe is too small to sell such products, that it must be the world market. But Japan has for some time been the strong man there, saying, "Ok, here we are, come and try your luck."

DER SPIEGEL: Why do the Europeans not cooperate with the Americans? They have the same problems as we do, and want to reestablish the U.S. supplier trade in technological equipment through their Sematech program.

Ruge: You are right, I am slowly coming to the realization that JESSI is a slow and long-overdue process simply because the Americans are so damn far ahead with Sematech. It would be nice if we could cooperate with the United States.

DER SPIEGEL: The Japanese invent something and are able to produce it. Then the Americans come along and attempt to reinvent it all. Then the Europeans do the same thing, in order to catch up. Do you see any logic in this?

Ruge: What kind of logic do you want? I mean, by now everyone has acknowledged what we specialists have been saying for years: Be careful, this is the basic material for a modern national economy that we do not want to forego. We were saying that 10 years ago. And today, everyone is saying that they need electronics in their country, because it is one of the most important commodities to a functional national economy. We need an appreciation of electronics on the broadest front, we need a special supply industry for water, chemicals, metal, gases and machines, because production of the new chips requires an industry of custom-made goods that is at the far limit of the technically possible. For this, you need a well-coordinated system and an enormous number of suppliers.

DER SPIEGEL: What should the Europeans do?

Ruge: Germans—and then Europeans—must strive more to achieve a general consensus. The economic system in the year 2000 must be structured differently from our current system. Right now, the idea is simply that future industries should do everything on their own, with the state staying out of subsidy business. The success of the Japanese is due on the one hand to their industriousness, their special care, their national consciousness, but on the other hand to their system, with its close cooperation between the state and industry. We can only learn from their example.

DER SPIEGEL: Mr Ruge, thank you for the interview.

FRG's Aixtron Develops Upgraded VPE Machine for III-V Compounds

AN890112 Paris ELECTRONIQUE HEBDO in French 16 Feb 89 p 27

[Article by Elisabeth Feder: "Vapor-Phase Epitaxy of III-V Compounds Enters Production Phase"]

[Excerpts] The growth of layers at 300 micrometers per hour and uniformity variation of less than 1 percent are the principal characteristics of a metal organic chemical vapor deposition (MOCVD) machine for vapor-phase epitaxy (VPE) intended for production.

Like all areas of microelectronics, optoelectronics requires sophisticated equipment, in particular because of the semiconducting III-V compounds used. By developing highly automated machines for producing VPE layers by MOCVD technology, the FRG company Aixtron has made its contribution to one of the most delicate phases of production.

The most distinctive characteristic of the metal organic VPE (MOVPE) equipment developed by Aixtron lies in its suitability for industrial mass production. Gone are the manual adjustment of parameters and fine tunings; microprocessors ensure the accuracy of all functions. Automation makes possible better reproducibility of epitaxial structures as regards thickness and uniformity. It is thus possible to produce epitaxial layers of gallium arsenide (GaAs), gallium/aluminum arsenide (GaAlAs), indium phosphide (InP), gallium/indium arsenide (GaInAs), and gallium/indium/arsenic phosphide (GaInAsP) with less than 1 percent variation in the uniformity of layer thickness on wafers 50 mm in diameter. The same precision is reached in terms of uniformity of doping. On 75-mm wafers, the variation in uniformity is less than 3 percent on 98 percent of the surface. In all cases, the epitaxial layer can be very thin, as fine as an atomic layer, while presenting a sufficiently homogeneous structure.

The Aixtron equipment can process wafers that are 50 or 75 mm in diameter: The most sophisticated machine can process either ten 50-mm wafers or four 75-mm wafers at one time, with the time involved depending on the materials making up the layer to be grown. The cost of an MOVPE machine begins at about Fr 1.7 million. A machine capable of processing approximately 100 50-mm slices is currently being developed. The company is also willing to tailor its equipment to the exact needs of its customers. It supplies growth parameters of layers on 50-mm wafers of all the above-mentioned materials, n- and p-doping profiles, and electrical and optical properties. The compounds developed and tested include multiple-quantum-well lasers of GaInAsP emitting at 1.55 micrometers, GaInAs lasers emitting at 1.3 micrometers, and oxygen-band planar lasers of GaAs/GaAlAs emitting at 0.85 micrometer, as well as positive-intrinsic-negative (PIN) diodes of GaInAs/InP, GaInAs, and InP metal insulator semiconductor field-effect transistors (MISFET), metal semiconductor field-effect transistors (MESFET), and GaAs/GaAlAs high-electron-mobility transistors (HEMT).

Founded in 1983 by researchers from the State of Rhineland-Westphalia School of Advanced Technology (RWTH), Aixtron, headquartered in Aachen, rapidly became a leader in the VPE field, with 70 percent of the European market. Five sets of equipment were delivered in 1988, and more than 20 have been ordered for 1989. Today, almost all major manufacturers of optoelectronic compounds have joined the competition. Aixtron's sales reached DM 14 million, or almost Fr 50 million in 1988. Its aim is to reach DM 22 million, or more than Fr 75 million, by 1990. To enter the North American market, a subsidiary was created in Atlanta in late 1987: Five sets of equipment have since been sold in the United States, which the company says represents 13 percent of the market in this sector.

Philips Reorganizes Chip Group

36980212 Rotterdam NRC HANDELSBLAD in Dutch 20 Apr 89 p 13

[Report on interview with H.W. Hagmeister, manager of Philips' Chip Group, by Dick Wittenberg: "Philips Will Make Drastic Changes in Organization of Chip Group]

[Text] Philips is going to make drastic changes in the organization of its chip activities. The American subsidiary company Signetics, which thus far has been operating rather independently, is being consolidated with the European chip group of Philips. The entirety will be subdivided into seven product groups which will have worldwide responsibility.

According to H.W. Hagmeister, cert. engr., who became the manager of the chip activities at the beginning of this month, this "integration and simplification of the decision-making structure" is intended to serve customers more efficiently and to be able to react more rapidly to market changes. Hagmeister says that, moreover, in the former situation the two company branches sometimes were involved in the same developments or were competing with each other.

According to him, the world market for integrated circuits continually shows big and unexpected regional shifts and, also, the development of new technology or of new products is often determined at the regional level. Hagmeister: "Without a global approach one cannot react to that adequately."

Three of the seven new product groups will be managed from Sunnyvale, the main establishment of Signetics in California. The other four product groups will be managed from Eindhoven. A separate group will also be formed there for static memory chips, the circuits which Philips has developed in the framework of the Megaproject. With respect to sales, Signetics will limit itself to North America from now on, while the rest of the world will be served from Eindhoven.

Philips wants to initiate the new organizational structure in a year and a half, "in order to cause as little disturbance as possible of the market contacts," says Hagmeister. He believes that the new structure will not have personnel consequences.

According to Hagmeister, complete integration of Signetics and the European chip activities only became possible after Philips strengthened its grip on the American activities a year and a half ago. Signetics is one of the oldest chip firms in Silicon Valley. The enterprise was founded in 1961 by four collaborators of Fairchild and has been Philips' property since 1975. Last year the company reached sales of over 600 million dollars, almost as much as the rest of Philips' chip group. Hagmeister does not think it impossible that the name Signetics will ultimately disappear.

According to Hagmeister the adaptation of the organization is not a reaction to the lagging growth of the chip group. He does hope, however, that the new structure will promote better performance. This will further be achieved through more rapid innovation and a reduction in costs, he says. With that in mind, the consulting organization Arthur D.Little has investigated whether the two largest European chip factories of Philips, in Nijmegen and Hamburg, function efficiently enough. Hagmeister does not wish to report on the results as yet.

Last year Philips booked an increase in sales in the chip sector of about 10 percent, while the other European competitors reported growth figures of between 19 and 26 percent and the world market increased by over 30 percent. According to Hagmeister that was mainly attributable to the lack of dynamic memory chips in Philips' product package.

Hagmeister says that Philips might be forced to also make dynamic memory chips in the future, in spite of the high investment, big risks and killing competition. That is because large buyers more and more often demand that a chip supplier furnish a complete product line. However, the concern has not yet made a decision to enter the dynamic memory chip field.

Hagmeister does not want to make any statement as to the yield from the chip group. He only says that the profit and loss account is strongly influenced by the investments Philips made in the framework of the Megaproject.

During the last five years, the enterprise invested a total of about 5 billion guilders in chips, about one quarter of its total investments. Hagmeister says that in the coming five years a considerably higher amount will be required to keep up.

SCIENCE & TECHNOLOGY POLICY

French 1989-93 Regional R&D Budgets Discussed

AN890134 Paris RECHERCHE TECHNOLOGIE in French Feb 89 p 9

[Article: "The 1989-1993 Planning Contracts Between the Central Government and the Regions"]

[Text] Negotiations for the 1989-1994 planning contracts between the central government and the regions were finalized on 10 February at an Interministerial Committee (CIAT) meeting. This contracting procedure, which seeks to coordinate the activities of the central government and the regions in a limited number of fields, has thus been renewed after a highly successful initial experimental period (1984-1988). The current contracts will be allocated Fr 96.8 billion (vice Fr 70 billion for the previous contracts), with Fr 53.4 billion coming from the central government and Fr 43.4 billion from the regions. They relate primarily to communications infrastructure, projects in support of marginal rural areas, training, local development, and employment.

In addition, each contract includes a research and technology component. The central government and the regions will allocate a total of Fr 3.5 billion to these cofinanced projects between 1989 and 1993, about 3.5 percent of the overall budget, representing a slight increase over the 3.2 percent of the previous contracts. The central government's contribution to these funds is on the order of Fr 1.9 billion over 5 years—slightly under Fr 1 billion from the Ministry of Research and Technology, Fr 230 million from the National Center for Scientific Research (CNRS), Fr 150 million from the National Institute for Agronomic Research (INRA), and Fr 250 million from the research budget of the Ministry of Education, with the balance coming from various technical bodies and ministries.

The operations under contract are essentially the following: the creation of topical, regional centers built around interdisciplinary research programs (specifically in the fields of materials, biotechnology and health); the promotion of technology transfer Regional Centers for Innovation and Technology Transfer (CRITT) and technological advisory networks); and scholarships and research contracts for senior technicians (CORTECHS). A limited number of projects requiring the installation of major scientific equipment or new buildings have also been contracted for. Some contracts involve the installation of major computer facilities (e.g., at the National Southern University Computing Center (CNUSC) in Montpellier, the IMT in Marseille, and the National Institute for Research on Information Science and Automation (INRIA) at Sophia-Antipolis). Lastly, proposals for the fostering of scientific and technical development were adopted.

The great variety of these contracts, in terms of both funding levels and subjects covered, is indicative of the diversity of the scientific potential of each region and of the various development strategies adopted by the regional councils.

TECHNOLOGY TRANSFER

French, Bulgarian Research Institutes To Cooperate

AN890135 Paris RECHERCHE TECHNOLOGIE in French Feb 89 p 11

[Article: "Franco-Bulgarian Bilateral Cooperation"]

[Text] In connection with the official visit by French President Francois Mitterand to the Bulgarian People's

Republic, Minister of Research and Technology Hubert Curien held talks on 18 January with Stoyan Ovcharov, Bulgarian minister of economics and planning.

Six topics in the field of scientific and technical cooperation received particular attention: electronics; computer technology, automation, and applied mathematics (including in the medical field); biotechnology (in the agro-food and medical fields); advanced materials (including those related to new technology); farming techniques; earth and ocean sciences (including environmental and disaster protection).

Ovcharov made a proposal to his French counterpart on joint funding for certain mutually advantageous scientific and technological projects. He outlined the new Bulgarian economic and scientific structures and stressed the importance of the industrial research institutes as partners in bilateral cooperation.

For his part, Curien—who was accompanied by Aubouin, president of the Academy of Sciences; Kourilsky, director general of the National Center for Scientific Research (CNRS), and Benoussan, president of the National Institute for Research on Information Science and Automation (INRIA)—discussed with Ovcharov the prospects for direct cooperation between the National Institute for Health and Medical Research (INSERM), the CNRS, and the Bulgarian Academy of Medicine, specifically in the fields of AIDS research, oncology, immunopharmacology, and molecular biology.

The two ministers agreed that all the topics discussed would be reviewed by the joint Franco-Bulgarian cooperation commissions.

President Mitterand, accompanied by the French delegation, was the guest of the Bulgarian Academy of Sciences. During a working session held at the Academy, a survey of the relations between the French and Bulgarian scientific communities was conducted.

COMPUTERS

GDR's A 5120 Computer Used in CAD Work Stations

23020062 East Berlin FEINGERAETETECHNIK in German No 2, 1989 pp 54-57

[Article by Dr Sci. Tech. P. Langbein, Dipl. Eng. M. Petzold, Friedrich Schiller University Jena, Technology Section: "CAD Work Station With Office Computer A 5120"]

[Text] To be able to effectively perform computer-aided design, CAD hardware must be available, interactive, and graphics-capable on the designer's work station.

CAD software should be designed in such a way that the largest possible program sections are usable for various areas of application. Special user programs are integrated via specific interfaces.

To meet planning, adaptational, and original design requirements, the A 5120 office computer has been configured, by connection of a raster display device K 8917, a digitizer K 6401, and a plotter K6418, as a CAD work station supported by an interactive graphic program system IGS-CAD (Fig. 1) [figure not reproduced].

This system makes it possible to use CAD to design simple technical structures, such as devices or assemblies for devices, for which reusable components can be called up from a databank system or sent to the computer using a digitizer and then positioned and adapted on the screen. Drawings are printed out using the plotter.

1. Interactive Graphic Program System IGS-CAD

1.1 Encoding of Component Data

The computer application dictates the methods used to encode component data. For CAD, geometric encoding is an important requirement. To make the geometric data of a component available within the computer for the purpose of changing the data as desired, it is necessary to model the actual component. The term "Geometric Modeling" has gained acceptance for characterization of the activities of converting the actual geometry of the component to a coding of the geometric data mapped in memory [1]. A conceptual model of the actual geometry is produced. It contains the properties and logical interrelationships for subsequent representation. This idea is transferred to a data structure which permits access to the necessary contents and interrelationships. Finally, the map of the data structure in processor storage generates the computer-internalrepresentation of the component. Figure 2 shows various types of models. A 2D model suffices for drawings. This model can fully represent reality only for axially symmetric parts and parts with constant thickness [2].

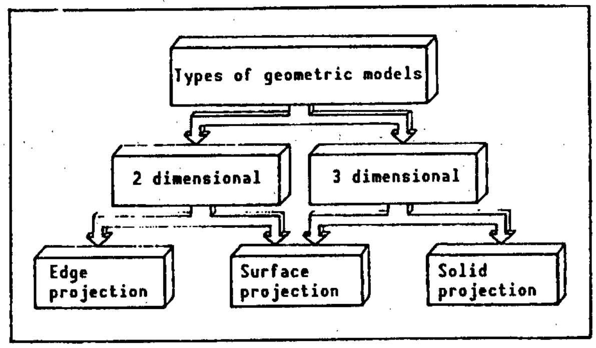


Figure 2. Types of Component Models

In all other cases, only partial reality is mapped. The simplest type of model is the edge projection. It includes only the contour edges in the plane of the sketch. Of course, its applicational possibilities are quite limited, but its advantages are the low storage overhead and the lack of complexity of the programs for encoding or interpreting the model.

For this reason, the 2D edge projection was used to encode component geometry. The data structure is shown in Figure 3.

This type of structuring permits grouping of elements, for example, grouping of geometric elements according to technical aspects. During graphics work, the grouped elements can be re-accessed. It is also possible to reference textual data.

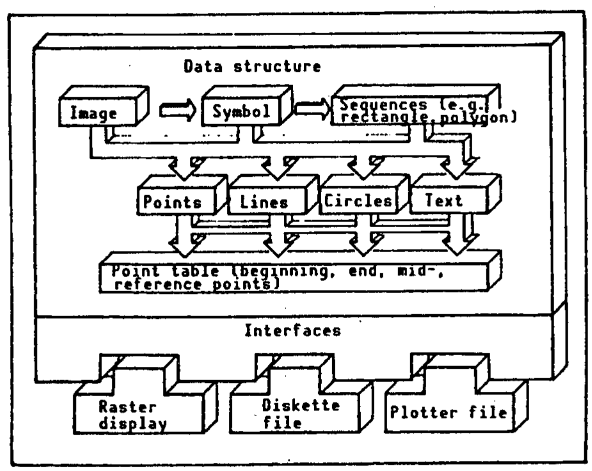


Figure 3. Simplified Data Structure of Images in the IGS-CAD Program

1.2 Graphic Output

Representation of the encoded data requires:

- interpretation of model content
- programs to control graphic output devices using the data gathered.

The objective is to separate these functional areas. This step occurs in virtually all CAD systems, especially in high performance systems. Based on such a design, it is possible to develop even relatively complicated programs with graphic processing.

"Interpretation of model content for graphic output" means decoding the data in the data structure into vector data.

The programs required for graphic output of these data may be combined as basic graphic software. They must provide basic, continually recurring I/O-functions as interfaces with the user programs or with other components of a CAD system. Examples of such basic functions are

- output of basic elements (point, line, circle, curves, text, etc.)
- modification of properties of elements which are output
- auxiliary functions for manipulation
- on-screen identification of elements.

Since interchangeability and multipurpose application of graphic programs are absolute requirements for CAD systems because of high developmental expense, use of universal basic graphic software becomes important.

In the IGS-CAD program, the graphic functions provided by the raster display device K 8917 are used for the graphic output interface [3]. The functions supported by the standard "core graphic system" permit creation of a graphic layer which is quite distinct from the processing of image data. This increases portability of the graphic layer as well as the transfer of the program to other output devices.

1.3 Memory Management

Mapping of data and their relationships to suitable storage structures is required for manipulation of the design components in the computer. Whereas the logical interrelationships of the model are contained in the data structure, mapping of the physical data in storage is accomplished via the storage structure. Data and storage structure must guarantee minimal storage overhead and rapid response times [4]. In addition to the logical aspects of data structuring, defining the storage model determines how the data are written to storage without performing the actual imaging. Three types of storage of geometric data predominate:

- sequential organization
- list organization
- direct access.

The choice of storage structure determines

- access time
- access capabilities
- storage overhead requirements.

The IGS-CAD program uses linear list storage. Entries to any storage locations desired are permitted. The ordering of the data is defined by additional locators. An element is searched for using the locator table. The image created is fully processed in the main storage of the office computer to assure the short reaction times necessary for interaction.

1.4 Menu Format

Working with the IGS-CAD program is accomplished using menus. For this, the set of instructions may be made available to the program user in various ways. The static menu shows the user the full range of possible instructions. The logical sequence of entries must be known.

In contrast, the dynamic menu displays only a portion of the set of instructions. Following selection of one capability, another portion is displayed for further selection. The user is thus led through his input.

The IGS-CAD program uses the dynamic menu format. All commands and messages are displayed on the office computer screen. The main menu first appears alone. To make menu control user friendly, a marker for menu selection is moved along the lines of the menu by the cursor keys. The main menu is followed by submenus which guide the user to the complete instruction. Figure 4 [figure not reproduced] shows the type of menu screen display on the office computer.

Entries are organized in such a way that followup from two submenus is adequate for all instructions.

2. Capabilities of the IGS-CAD Program

The IGS-CAD graphic package is used for interactive graphic generation and manipulation of two-dimensional structures. It is based on the creation of drawings of individual parts and drawings of simple assemblies [5]. Drawings may be generated through:

- input of geometric elements of the surface plane
- use of macro and variant techniques
- contour intake via a digitzer.

The drawings are

- displayed on a raster display device
- altered
- archived to diskette
- output on a plotter.

2.1. Image Generation

Multiple capabilities for image generation are available to the user:

- input of basic elements (point, line, circle, arc, text)
- input of related elements (polygon made up of lines, rectangle)

- invariable macros (e.g., symbols for detailing of drawings)
- variable macros (frequently recurring parameterized shape elements)
- input of design-related points (e.g., crosslines on the raster display device, absolute and relative coordinates, intersections, text reference points, macros, etc.)
- intake of complete contours via the digitizer.

A number of "variable macros" are available to the user for original design of components. These are shape elements which are drawn in the desired size after positioning in the image through input of a few parameters. Figure 5 shows a section of the menu table.

Parameter changes may be made individually or globally as standard parameters according to TGL's [GDR technical standards].

Input and correction support:

- work in any section of the image
- separation of combined elements and macros for manipulation of single elements
- erasing
- shifting
- rotating
- mirror imaging
- raster support
- defining new image dimensions

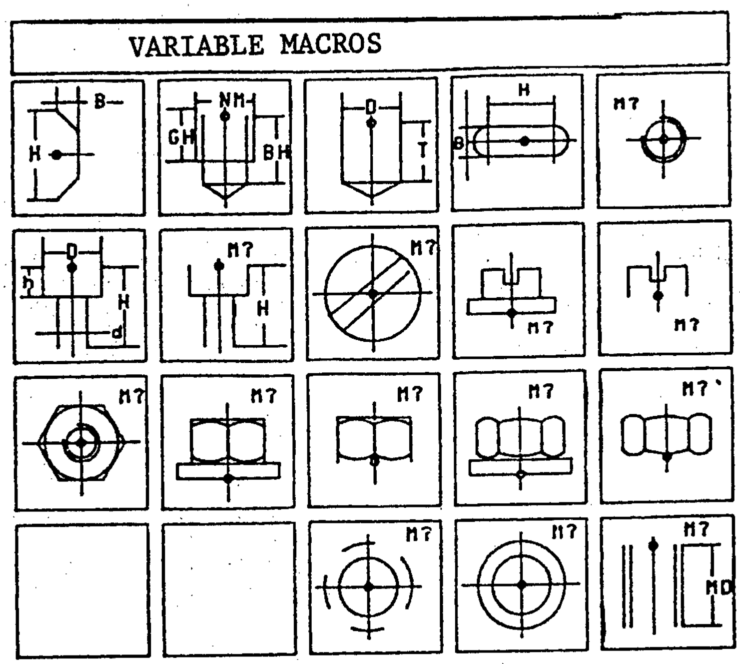


Figure 5. Menu for Selection of Shape Elements on the Digitizer

If existing components and assemblies are to be reused, the program system permits intake of the contour of a single part out of a composite drawing (Fig. 6) [figure not reproduced]. The component may be detailed using macro techniques and manipulation capabilities (Fig. 7) [figure not reproduced].

2.2 Manipulation

The following manipulation capabilities are available to the user:

Changes in the characteristics of the display:

- changes or adjustments in type and thickness of lines
- changes or adjustments in text parameters: text height, text width, text slant, and letter spacing.
- multiplication of macros any number of times in the drawing plane, along a straight line or an arc
- combining of any desired elements into macros.

Support for detailing of drawings:

- shading
- dimensioning
- macros for shape elements of mechanical assemblies
- macros for machining drawings.

2.3 Output

The simple model of the component is interpreted for output. Different formats are generated for the various output devices:

- For the raster display device K 8917, the program generates and sends graphic records corresponding to the specifications of the raster display device

- for the diskette file used for storage and archiving images and where all data such as real coordinates, characteristics of the elements, and associations are filed
- for the plotter K 6418, whose commands are generated and transmitted by the image structure.

Various interfaces for transmission of 2D-image data to other systems can be developed to user specification.

3. Connection of the Office Computer K 5120 With Peripheral Devices

Included in the program are the logical and physical drivers for data exchange with the following devices:

- raster display device K 8917
- high resolution digitizer K 6401
- plotter K 6418.

These device-specific programs may be invoked using the TURBO-PASCAL programming language. There is a program library for each device which makes it possible to use the interfaces in other user programs for the office computer A 5120.

3.1 Raster Display Device K 8917

The software interface for the raster display device contains "procedures" in TURBO-PASCAL source text for graphic processing with the raster display device which were created specifically for the IGS-CAD program. The programs provide the following capabilities:

- Preparation of graphic records according to the graphic control specifications of the raster display device
- conversion of user coordinates into device coordinates of the raster display device and vice versa
- transmission of graphic records
- reception of graphic records.

The procedures do not generate a runtime register. The status of graphic output is managed through the graphic program. This procedure assures the least possible program size for graphic output.

The communication module for the software package GKSR 1520 was developed by the Dresden Technical University Mathematics Section. It contains the logical and physical driver for the I/O communications via SIO channel A of the office computer [6].

Two modifications were made for use with TURBO-PASCAL:

- Since the transfer module is highly modular in configuration and contains several subprograms which can be used separately, the beginning of the routine consists of a branch table.
- The routines were designed as "IN-LINE procedures".

3.2 Digitizer K 6401

The interface to the digitizer likewise contains several programs in TURBO-PASCAL source text to handle function control, coordinate transmission, and error management.

Ten functions are available for use in the graphic program:

- start K 6401
- presetting of coordinate digitizing
- reference point input
- origin input
- coordinate digitizing
- menu-driven macro callup
- drawing text
- parameter input
- cursor control
- stop K 6401.

After the program is started, a loading routine included in the graphic program automatically transmits the loadable part of the function software "HDGASS" [7].

During work using the digitizer, program control, menu selection, and parameter input take place via the digitizer. During input of lines and polygons, angle and intersection correction are performed.

3.3 Plotter K 6418

The drive programs for the plotter K 6418 handle transmission of edited commands.

The communication program converts stored image data into plotter commands and transmits them via a parallel interface.

4. Summary

With the CAD work station introduced here, it is possible to solve design problems of planning, adaptational, and original design of simple technical structures or assemblies. With it, a royalty-free work station using the configuration of office computer A 5120, raster display device K 8917, digitizer K 6401, and plotter K 6418 is offered. The present program system IGS-CAD is structured in such a way that it presents a good starting point for interactive graphic systems using ESER-PC technology.

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Use of Fiberoptic Technology With the GDR's EC 1834 Described

23020057 East Berlin NEUE TECHNIK IM BUERO in German No 2, 1989 pp 39-41

[Article by Dip.-Eng. Karlheinz Reimann, VEB Robotron-Elektronik Dresden, and Dipl.-Eng. Gert Ittner, VEB-Robotron-Buchungsmachinenwerk [Accounting Machine Plant] Karl-Marx-Stadt: "Fiberoptic Technology With the EC 1834 Personal Computer"]

[Text]

1. Introduction

In keeping with the central decisions on the introduction of fiberoptic technology as a key technology, the optical channel must also be generally provided as the medium for data transmission over short distances in the development of new products, in order to effectively counter a further increase in the national economy's demand for copper. With the production of workstations and personal computers in large numbers, this is already assuming increasing importance with regard to the creation of complex networks. Components which permit asynchronous data transmission via the V.24 interface and which use optical waveguides as the transmission medium are currently under development. With these, the transmission distance can be raised to approximately 1,000 meters without the connection of modems (zero-modem-system), and the functional advantages of fiberoptic transmission, such as resistance to interference, potential separation, and a high level of data security can be obtained for the user. At the same time, a microprocessor controlled interface multiplexer which uses cascading to permit connection of up to 64 terminals to one interface channel of the EC 1834 is being created (Fig.1).

2. Serial Communication Adapter With Fiberoptic Interface (ASL)

2.1 Basic Functions

The ASK Type 1211 adapter is used for EC 1834 serial data transmission via the V.24 or IFSS interfaces. The

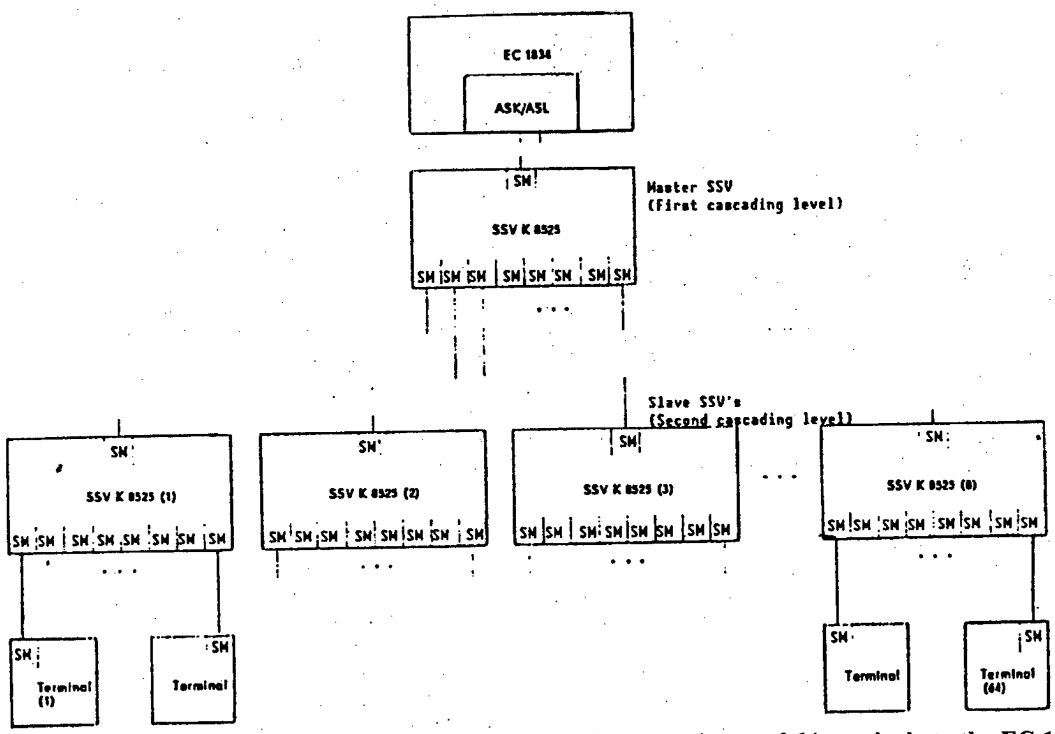

Fig. 1 Diagram of a mixed electrical and optical system for linking a maximum of 64 terminals to the EC 1834. SSV = Interface multiplexer; SM = Interface module for V.24, V.11, IFSS, or LWL [fiberoptic] connection

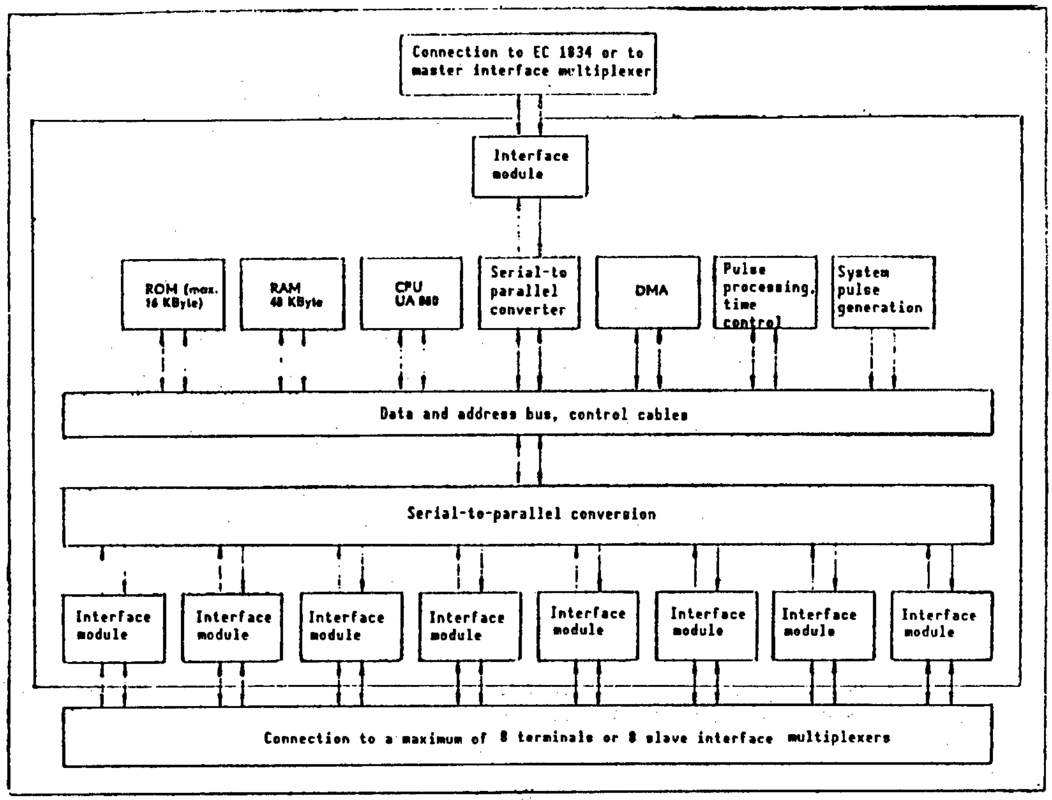

Fig. 2 Schematic diagram of the interface multiplexer

adapter for serial communication with the ASL Type 1213 fiberoptic interface corresponds logically and functionally to this variant in asynchronous operation. The ASL adapter provides two independent transmission channels A and B with one send and one receive channel each which can be operated in full duplex. It is fully programmable and can be used for asynchronous transfers with data rates between 50 and 19,200 baud. In the EC 1834 system, it can be used in place of or in connection with the ASK adapter for electrical transmission and is also usable either as a primary or secondary adapter.

2.2 I/O Addressing

Address fields used:

- 3E0H to 3EBH primary adapter
- 2E0H to 2EBH secondary adapter.

Address fields which lead to NMI-interrupt:

- 3F8H to 3FFH primary adapter
- 2F8H to 2FFH secondary adapter.

2.3 System Bus Connection

The ASL adapter is handled by the EC 1834 processor as a pure I/O device with the addresses indicated above. Depending on the characteristics of the LSI circuitry used, write or read procedures to the I/O ports addressed are possible. All I/O ports are 8-bit devices, i.e., they can only be used with 8-bit I/O commands from the processor. The control circuit is reset by means of the RESET-DRV signal on the system bus. The timing pulses for the adapter circuit are derived from the system bus timing signal. In the control of transfer operations, it is possible to choose interrupt operation where, in principle, the IRQ3 or IRQ4 interrupts of the system bus can be activated. For this, the interrupt output of the SIO and IRQ4 (primary adapter) is turned on so that parallel operation of two ASL adapters or a mixed configuration of one ASK and one ASL adapter is possible with interrupt. Both interrupt connections IRQ3 and IRQ4 are only activated when the associated control bit is set.

2.4 Setting Data Rates

A timer circuit (PIT) is used on the ASL adapter to generate the SIO pulses. It includes three 16-bit counters which can be loaded and read independently of one another. Counter 0 (channel A) or 1 (Channel B) can be used for baud rate generation. The counter values to be set are indicated in Table 1. All three counters are timed with the octal OSC pulse of the system bus (1.8432 MHz).

Table 1: Baud Rates To Be Set for ASL Adapter

Baud Rate	Counter Values (16 x Clock)		Error (percent)
	Decimal	Hexadecimal	
19,200	6	006	-
9,600	12	00C	-
7,200	16	010	-
4,800	24	018	-
3,600	32	020	-
2,400	48	030	-
2,000	58	03A	0.69
1,800	64	040	-
1,200	96	060	-
600	192	0CO	-
300	384	180	-
150	768	300	-
134.5	857	359	0.058
110	1,047	417	0.026
75	1,536	600	-
50	2,304	900	-

2.5 Interface

The ASL adapter converts the electrical transmission data TxD into optical signals for both communications channels A and B and reconverts the optical signals received into electrical reception data RxD. With regard to the optical signal, both transmitter and receiver operate without inverting (i.e., high level generates light or light generates high level). To achieve flexibility in the management of levels, it is possible to set the control with inverting or noninverting transmission data for each transmitter. The data transmission speeds possible are adapted to the specifications of the V.24 interface. They equal from 0 to less than or equal to 30 kbits/sec with a permissible level drift of a maximum of 10 percent or from 0 to less than or equal to 60 kbits/sec with a maximum drift of 20 percent. Transmission distance is determined by the VQ 170 optodiodes used as transmitters and the SP 107 optodiodes as receivers as well as by the attenuation of the fiberoptic cable used and can range from 1 meter to approximately 1,000 meters. The optical output of the transmitter is broadly adjustable and can be adapted to quite varied cable attenuations.

2.6 Transmission Medium

For point-to-point connection of the system components, two single-wire fiberoptic cables with connectors with the stepped index profile of the type LWLK 1X1S TGL 55143, which are operated unidirectionally, are required per transmission channel. In the event of high mechanical demands on the cables, the reinforced version LWLKv 1X1S can be used. No metallic conductors are used in these cables; therefore, remote powering of system components is not possible. However, security level specifications can be met ideally because of the potential separation. In assembly and laying of fiberoptic cables, the general requirements pursuant to TGL 55141/02 must be complied with. Single-wire fiberoptic cables are more advantageous in terms of prime costs, connector assembly, and replacement of defective cables than two-wire fiberoptic cables.

3. Interface Multiplexer (SSV), K 8525

A variety of applicational solutions based on the EC 1834 (detection systems, monitoring systems, control systems, reservation systems) require the connection of several terminals to one serial interface of the control computer. In addition to various bus and ring structures, the star connection of these terminals via interface multiplexers is offered as a solution especially for systems with high data security requirements. The interface multiplexer SSV K 8525 as a programmable computer unit based on the UA 880 processor offers the possibility of connecting one serial interface to as many as eight slave interfaces. Thus, by cascading the interface multiplexers in two levels, it is possible to connect as many as 64 terminals to the EC 1834. To meet extremely varied user demands (linkage with technology already installed, meeting various distance and speed requirements, effect of areas of electromagnetic interference, etc.), the interface multiplexer offers a high degree of modularity. Each of the nine serial channels of the interface multiplexer can be varied both in its physical and logical parameters. For physical adaptation of the data to be transferred to the transmission path, interface modules are used which are plugged into the control board of the interface module using connectors. In addition to interface modules for the following standardized electrical interfaces:

- V.24 corresponding to CCITT/RS 232 C, roughly equivalent to TGL 29077/01, 02
- V.11 corresponding to CCITT/RS 422
- IFSS (20 mA-current loop) pursuant to TGL 42886,

a fiberoptic module is offered for optical point-to-point connection in the lower speed ranges (similar to ASL); this module will also be used in a new generation of magnetic-card-based detection and monitoring terminals from the VEB Robotron-Buchungsmachinenwerk Karl-Marx-Stadt. This module includes both a transmission and reception level (1 channel) which matches the interface assemblies of the ASL 1213 in terms of circuit design and user parameters. The uniform circuit design in all components of the system permits comprehensive solutions for purely optical or mixed electrical and optical networks.

It is thus possible to develop user systems optimally adapted to the project and to use the new fiberoptic technology extensively in the process.

During a first stage, the use of fiberoptic components will occur only in complete applicational solutions from the VEB Robotron Combine. Later they will be available within the framework of delivery configurations. The fiberoptic adapter for the EC 1834 is the first in a series of products for further Robotron computer technology.

FACTORY AUTOMATION, ROBOTICS

GDR Modular Flexible Assembly System Described

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[Article by Dr K. Trinsinger of Chamber of Technology and VEB Research, Development and Rationalization of Heavy Machinery and Plant Construction, Dresden, and Dr M. Weise of Chamber of Technology and Karl-Marx-Stadt Research Center for Machine Tool Construction at the "Fritz Heckert" VEB Machine Tool Combine, Karl-Marx-Stadt: "Modular System for Flexible Assembly Automation in Machine Building"]

[Text] 0. Introduction

In the assembly process, approximately 80 percent of the total time spent on assembly still involves manual activities, despite significant efforts to rationalize, mechanize and automate. The reasons for this are the complexity of the assembly processes and production lots that are too small for rigid automation.

With the advent of modern industrial robot technology, devices are now available that, in combination with flexible automated assembly equipment, provide the basis for automated assembly of small to medium-sized lots as well. Of particular note here is the purposeful exploitation of the flexibility of industrial robot technology to achieve operation at full capacity, by using a common apparatus for several assembly units, even different kinds of them (1).

The best-known form of automation of assembly processes, which has been tested in practice for many years, is the automatic assembly machine. It is often mechanically controlled, but the workpiece flow system and operational units scarcely permit rapid retooling for other products. The result of this is that automatic assembly machines can be used economically only where products are manufactured over a long period of time with no modifications, and the annual lot size is greater than 300,000.

At present, the trend is in the direction of ever-shorter periods of time in which new products must be introduced on the market, so that the production period is becoming shorter. Furthermore, many products in the GDR are being produced in annual lots of only 3,000 to 300,000 units. These circumstances necessitate the assembly of several similar products on one automated system, and rapid conversion to modified products without costly retooling. For this, flexible assembly automation is needed. This can be implemented in three basic forms:

- Flexible assembly lines
- Flexible automated assembly cells
- Flexible automated assembly stations (2)

Flexible Assembly Lines

The distinguishing feature of flexible assembly lines is that several stations (analog to the work stations of a standard assembly line) are flexibly interconnected—e.g., by conveyor belts and addressable overhead conveyors—and that programmable assembly and manipulation equipment is used at the stations. Flexible assembly lines can be automated at all stations, but they can also be a combination of automated stations and manual work sites. One special form is the combined parts production and assembly line.

Flexible Automated Assembly Cells

Flexible automated assembly cells are machines consisting of largely automated and system-specific subsystems, most notably for:

- Joining
- Workpiece manipulation and storage
- Tool manipulation and storage
- Control
- Supply and waste disposal
- Diagnosis and quality assurance

These assembly cells are able to automatically assembly products or components that are similar in their primary dimensions without the need for costly adjustments in the cell. This makes it possible to make economical use of assembly cells as assembly equipment in areas requiring smaller lot production. This represents an entirely new possibility for automation in the future.

Flexible Automation Assembly Stations

Flexible automated assembly stations are technical setups for performing primary and auxiliary steps during the assembly process. Primary steps are joining processes standardized according to TGL [Technical Norms, Quality Standards and Delivery Conditions] 21 639, and in some cases non-joining processes, such as forming or disjoining. Auxiliary processes are lifting, issuing, turning, rolling and checking (3).

1. Requirements of a Modular System

The requirements of an assembly system can vary greatly according to the product in question, especially with respect its geometry, quantity and the necessary joining processes. The user wants an adaptable and quickly convertible—i.e., flexible—assembly system. Economic, problem-oriented solutions can be formulated on the basis of a modular system of functional units, or building blocks. By combining modules and system variations, an effective solution can be found for the specific application—the assembly process.

Flexibly automated assembly systems must perform very different functions, which must be implemented by multifarious technical elements. The essential functions are depicted in Figures 1a and 1b.

Most of the products in machine building that are to be assembled using automation are characterized by the following features:

- Range of dimensions of the products: 80 mm x 80 mm x 80 mm to 800 mm x 600 mm x 600 mm
- Weight of the products: up to 100 kg
- Type of production: small- and medium-lot production, i.e., production lots of 5,000 to 300,000 products per year
- Weight to be manipulated: up to 20 kg

2. Structure of the Module System

Based on the functions that the various systems for flexible automation of assembly must perform, the modular system must have the technical means by which the functions can be carried out and they can be linked to higher-order systems.

Because of the diverse nature of the technical means needed to automate assembly, a hierarchical system of the individual modules is necessary (4).

Flexibly automated assembly systems in principle require the first-order modules depicted in Figure 2. The modules for basic technological functions play a significant role here. There can be corresponding modules for all joining processes in keeping with TGL 21 639, e.g., for screwing, inserting, fusing, spreading, backjoining, etc.

However, the first-order modules depicted in Figure 2 represent only categories. In practice, they are put into effect in the form of significantly differentiated technical elements, i.e., second-, third-and lower-order modules.

2.1. Second-, third- and fourth-order modules, based on the example of the "module for manipulation" category

In a second-order modular system, the various technical means for manipulation are roughly categorized and specified by third-order modules (Figure 3). The modules defined here in turn consist of elements that can have a greater degree of independence and can be combined with corresponding modules in other categories.

Fourth-order modules, as depicted in Figure 4, are generally the elementary technical means from which flexible automated systems can be developed. Each fourth-order module must have very specific technical parameters, and can be realized in the form of series of products or modifications.

For example, it is typical that a clamp gripper for assembly will consist of a sensor unit for measuring axial and radial forces, an uncontrolled joining mechanism (RCC section), a gripper changing system and the gripper itself.

With the same fourth-order modules, various gripping and joining functions can be performed by changing the tool.

For example, it is possible to use the universal gripper depicted in Figure 5 [not reproduced] to grip primarily in a rotation-symmetric direction. With the gripper in Figure 6 [not reproduced], case-shaped parts can be grasped in a form-locking position, and the gripper in Figure 7 [not reproduced] can be used to join wave retaining rings.

2.2. Modular structure based on the example of a screwing station, robot-controlled, with torque and rotational angle electronics

This module's position in the overall system is as follows:

1. Module for basic functions of production technology

1.3. Module for pressing and compressing

1.3.1. Module for screwing

1.3.1.4. Screwing station, robot-controlled, with torque and rotational angle electronics

The following additional functional components with a modular character pertain to the screwing station (module no. 1.3.1.4.).

Module No. with name:

1.3.1.4.01. Torque, rotational angle indicator

1.3.1.4.02. Screw axis control unit

1.3.1.4.11. Screw head for M6 nuts

1.3.1.4.12. Screw head for M8 nuts

1.3.1.4.13. Screw head for M10 nuts

1.3.1.4.21. Screw head for flange M6 screws

1.3.1.4.31. Screw head for BM6 x 16 stud bolts, according to TGL 0-835

1.3.1.4.32. Screw head for BM8 x 25 stud bolts, according to TGL 0-835

1.3.1.4.41. Level screw head for M8 nuts

(1) Modul-kateg.	Funktionelle Anforderung	Begriff	Sinnbild
1 (2)	Fügen mit verfahrensspezifischer Fügeeinrichtung	Fügen	Fs
(3)	Fügen mit verfahrensflexibler Fügeeinrichtung	Fügen	Fi
(4)	Anwenden von Einrichtungen ohne Fügeinhalt, z.B. Simulation einerFügebewegung	Hilfsverrichtung	H
(5)	Prüfen oder Messen von Werkstücken oder Werkzeugen	Kontrollieren	K
(6)	Ausführen von fügefremden Verrichtungen im Montageprozeß	Teilefertigen	T
2 (7)	Halten von Werkstücken/Werkzeugen unter Anwendung von Kraft- oder Formschluß	Spannen	
(8)	Freigeben von Werkstücken/ Werkzeugen durch Lösen des Kraft- oder Formschlusses	Entspannen	
(9)	Gesteuertes Lagefixieren von Werkstücken und/oder Werkzeugen	Positionieren	
3 (10)	Manipulieren mit festprogrammierbarem Einlegegerät	Einlegen	
(11)	Sichern eines Bauteiles in einer bestimmten Lage	Greifen	
(12)	Manipulieren mit freiprogrammierbarem Montageroboter	Manipulieren	M
4 (13)	Geordnetes Ablegen und Bereitstellen von Werkzeugen in einer Speichereinrichtung	Magazinieren	W
(14)	Geordnetes Bereitstellen von Bauelementen aus ungeordnetem Speicherzustand	Ordnen aus Speicher	
(15)	Geordnetes Speichern von Bauteilen	Magazinieren	

(1) Modul-kateg.	Funktionelle Anforderung	Begriff	Sinnbild
5 (16)	Fördern von Werkstücken und/oder Werkzeugen zwischen bzw. in Fertigungs- und/oder Werkstückflußeinrichtungen	Fördern	
(17)	Übergeben in eine Grundstruktur des FAMS	Eingeben	
(18)	Übernehmen aus einer Grundstruktur des FAMS	Ausgeben	
(19)	Trennen des Materialflusses in zwei Ströme	Abzweigen	
(20)	Verbinden von mehreren Materialströmen zu einem Materialfluß	Zusammenführen	
(21)	Anhäufen von Werkstücken zum kurzzeitigen Ausgleich von Zeitdifferenzen im Montageablauf	Puffern	P
6 (22)	Steuern mit numerischer oder nichtnumerischer Steuereinrichtung (NC/CNC)	Steuern	ST
(23)	Prüfen vorgegebener Bedingungen	Sensor	
(24)	Anwenden von Arbeitsschutz- und Porzeßsicherheitstechnik Sensorik	Sichern	SI
7 (25)	Bereitstellen, Wandeln und Aufbereiten von Energie	Energie bereitstellen	
8 (26)	Handarbeitsplatz zur Ausführung nicht automatisierter Verrichtungen	manuelles Fügen	H
(27)	Steht dann, wenn eine Funktion weggelassen werden kann, ohne die Gesamtfunktion eines Systems zu gefährden	mögliche Anwendung der Funktion	Hinweis

Figure 1. Functional requirements and functional symbols based on TGL 28 482

Key: 1. Module category; Functional requirement; Term; Symbol—2. Join with process-specific joining device; Joining—3. Join with process-flexible joining device; Joining—4. Use equipment without joining, e.g., simulation of joining movement; Auxiliary device—5. Check or measure workpieces or tools; Controlling— 6. Perform non-joining actions in the assembly process; Produce parts—7. Holding workpieces/tools using frictional or form closure; Gripping—8. Release workpieces/tools using frictional or form closure; Ungripping— 9. Controlled fixing of position of workpieces and/or tools; Positioning— 10. Manipulating with a permanently programmed insertion device; Inserting — 11. Securing a component in a particular position; Gripping — 12. Manipulating with freely programmable assembly robot; Manipulating — 13. Proper placement and supply of tools in a storage facility; Warehousing — 14. Proper supply of components from a disorganized state of storage; Arranging from storage — 15. Proper storage of components; Warehousing — 16. Conveyance of workpieces and/or tools between or in direction of production and/or workpiece flow — 17. Delivery to a basic structure of the FAMS; Input — 18. Receiving from a basic structure of the FAMS; Output — 19. Splitting of the material flow into two flows; Branching — 20. Combining several material flows into one material flow; Funneling — 21. Accumulating workpieces for short-term settlement of time differences in assembly process; Buffering — 22. Controlling with numeric or non-numeric control unit (NC/CNC); Controlling — 23. Checking set conditions; Sensor — 24. Applying industrial protection and process safety technology sensors; Safeguard — 25. Supply, conversion and reconditioning of energy; Supplying energy — 26. Manual labor station for performing non-automated activities; Manual joining — 27. For when a function can be omitted without jeopardizing the overall function of a system; Possible application of the function; Note.

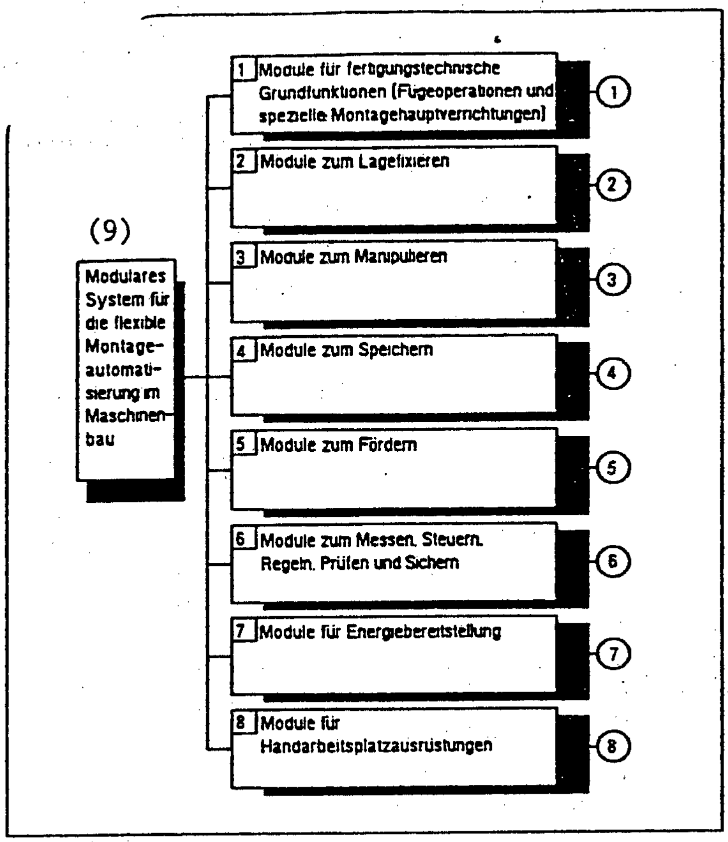

Figure 2. First-order module for flexible automated assembly systems

Key: 1. Module for basic functions of productions technology (joining operations and special primary assembly functions) — 2. Module for positioning — 3. Module for manipulating — 4. Module for storing — 5. Module for conveying — 6. Module for measuring, controlling, checking, testing and safeguarding — 7. Module for energy supply — 8. Module for manual workplace equipment — 9. Modular system for flexible assembly automation in machine building

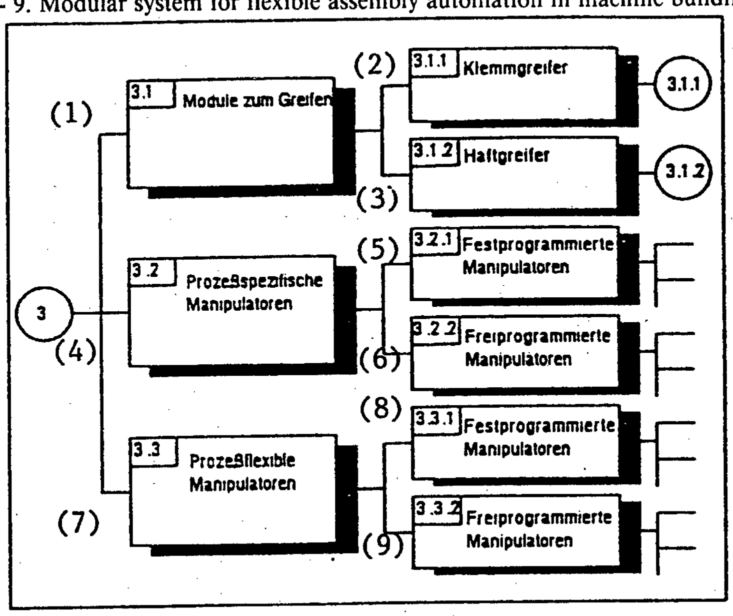

Figure 3. Second- and third-order modules for manipulating

Key: 1. Module for gripping — 2.Clamp gripper — 3. Pressure gripper — 4. Process-specific manipulators — 5. Permanently programmed manipulators — 6. Freely programmed manipulators — 7. Process-flexible manipulators — 8. Permanently programmed manipulators — 9. Freely programmed manipulators

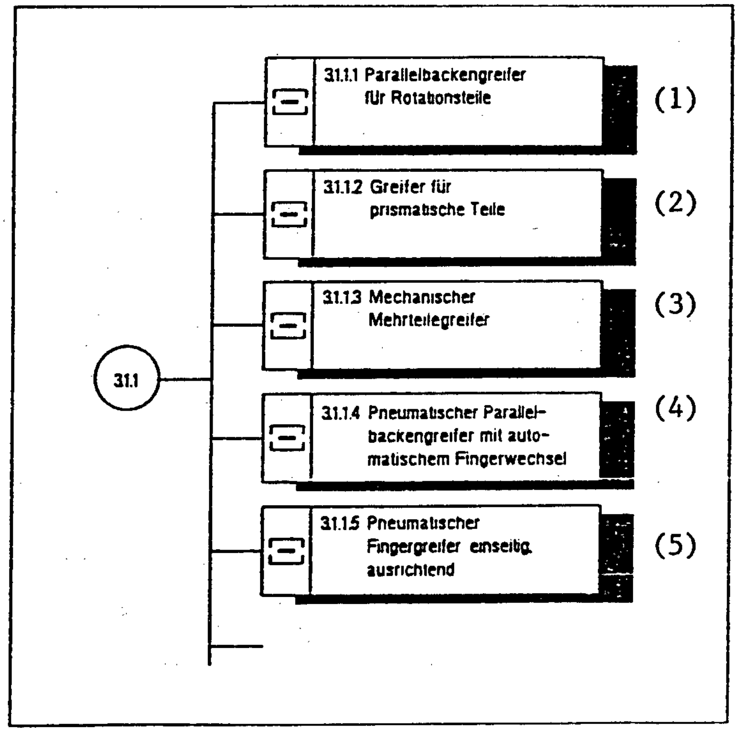

Figure 4. Fourth-order module for clamp gripping

Key: 1. Parallel jaw gripper for rotating parts — 2. Gripper for prismatic parts — 3. Mechanical multiple-part gripper — 4. Pneumatic parallel jaw gripper with automated finger replacement — 5. Pneumatic finger gripper, single face, aligned

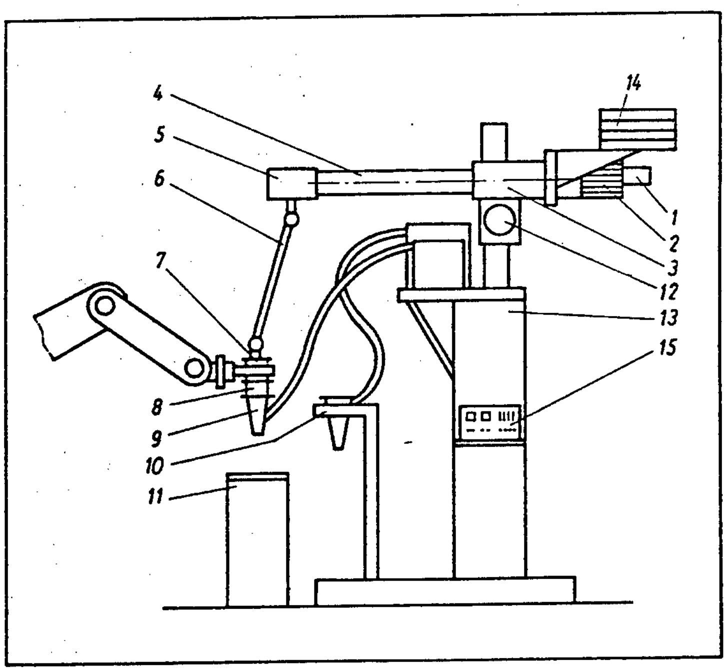

Figure 8. Solution for screwing station

Key: 1.Incremental indicator (IGR) — 2. RSM10 or RSM60 motor operator — 3. Torque/rotational angle indicator — 4. Swivel arm — 5. Worm gear — 6. Double-jointed spindle — 7. Gripping unit for robot — 8. Replacement mechanism — 9. Screw head — 10. Tool magazine — 11. Workpiece support — 12. Swivel bearing — 13. Stand — 14. Counterweight — 15. Screw axis control unit

Figure 8 shows the solution for the screwing station with its modules, some of which are presented in (5).

In connection with an industrial robot workplace, the screwing station is also used as a peripheral device for executing torque- or rotational angle-controlled screwing with automated feed and isolation of standard parts (6).

Technical parameters

Working space: diameter 600 mm, height 400 mm Drive technology, see Table 1 Surface area: 2,000 mm x 1,000 mm Thread size: M6 to M10 Screwing direction: vertical from above, horizontal (with mitre gear and module 1.3.1.4.41.) Torque control: torque-controlled, rotational angle-controlled

Table 1. Drive technology

Driving motor	Step-up of the worm gear	Max. screw moment N x m	Turns per minute, U/min	Tightening, U/min
Motor operator	1:10	20	1/200	1/30
RSM10	1:15	30	1/130	1/30
Motor operator RSM60	1:10	60	1/200	1/30

Summary

Given the tasks involved in automating assembly in the area of heavy machinery and system construction and tool and processing machine building, a modular system for flexible assembly automation for products typical to machine building was designed and used for concrete applications. This represents a contribution to increasing the effectiveness of assembly automation in the machine building sector.

The content and structure of the modular system was presented, based on already-developed modules. The modules presented can be used for various automation solutions in the area of assembly.

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NUCLEAR ENGINEERING

Application of GDR's ALFA 2 Code System Examined

23020033 East Berlin KERNENERGIE in German No 10, 1988 pp 429-433

[Article by C. Ludena Urquizo, Technical University Dresden, Section Energy Conversion, Scientific Sector Nuclear Energy]

[Excerpts] **Summary**

The analysis of a coolant-loss accident case represents a major component of safety considerations for nuclear power plants. The main objective of the theoretical and experimental work is the model representation of disturbance-caused physical processes. These models are converted into computer programs which will be of considerable help in safety studies. The ALFA 2 program system is a mathematical simulation model for the study of the thermo- and fluid dynamics of the accident atmosphere within the safety enclosure. Following a brief description of the physical bases of the calculation model, we represent in this paper sample calculations for the containment of a pressurized-water reactor with a power of 1,000 MW.

1. Introduction

In safety studies for nuclear power plants with pressurized-water reactors, considerable attention is directed to the incidence of coolant loss. This is attributable to the fact that during a reactor-coolant loss particularly complex thermo- and fluid-dynamic phenomena occur, and extensive safety facilities will have to be involved.

The safety enclosure, as an essential safety system, in addition to protecting the reactor-facility against external effects, also holds back any disturbance-causing agents.

Following the discharge phase of a coolant-loss incidence, a steam-air atmosphere is created within the safety enclosure. In order to lower the thermodynamic parameters of the gas mixture and thus to keep the integral strain on the safety structure as low as possible, it is necessary to condense the steam component with the help of heat-removing systems. We must look in this context at the following temperature- and pressure-reducing processes:

1) Heat removal through safety feed by means of an emergency cooling system and building sprinkler cooling system;

2) Heat removal by safety systems such as wet condensers, circulating air and drain recooling;

3) Heat exchange of containment atmosphere with building drain and installations;

4) Heat conduction through the wall into the environment.

Familiarity with thermo- and fluid-dynamic processes, as they occur following the discharge phase of a coolant-loss accident is an absolute necessity both for calculation of the strain parameters (pressure, temperature span on the wall) and evaluation of the existing safety potential.

2. The Program System ALFA 2

Development of the ALFA 2 program system originated in the need of precalculating the individual phases of a coolant-loss incident with its varying properties. With respect to this, ALFA 2 combines three calculation models for execution of short-, medium- and long-term calculations of the accident [7].

To describe the pressure build-up during the discharge phase, ALFA 2 utilizes a slightly modified version of the calculation model shown in [1] and [2]. ALFA 2 uses here in the energy balance of a discrete volume (zone) the kinetic components of the energy flows, and with a "fine" breakdown of the safety enclosure together with a nonsteady mass flow calculation, the model can well simulate the rapid phenomena of this phase. For simulation of heat removal through the wall, ALFA 2 makes it possible to calculate the heat transfer value, taking into account local flow conditions [2].

For mean-time calculations (approximately to 300 s), the kinetic components of the energy flows into a zone are no longer taken into account, and calculation of the mass flows proceeds in a quasi-steady manner. Simulation of the long-term phase proceeds on the basis of the ALFAL [3] model. So as to take the conditions of the long-term phase of a coolant-loss disturbance into account, the following physical phenomena were additionally modeled mathematically in ALFAL [7]:

1) The pressure removal with the help of the return-air cooling system;

2) The effect of post-decay heat on the thermo- and fluid dynamics of the containment atmosphere;

3) The mass energy transfer between the spaces due to pressure-equilibrium and convection flows.

[Passage omitted] The model makes it possible to proceed with a differentiation when applying the pressure removal systems for every zone. This means that long-term cooling enters the balance only when calculating the alleged rupture area. The energy flow brought into the rupture area due to long-term cooling can be determined with an exponential formulation for the post-decay heat [5].

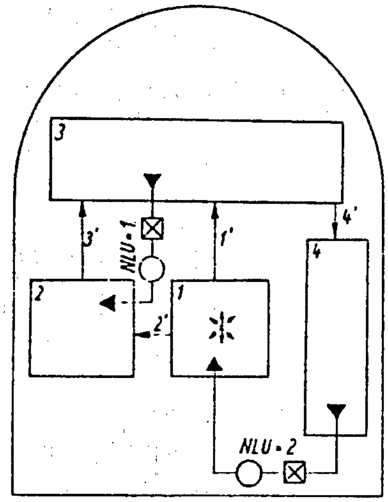
To take the return-air facility into account, the return-air connections between the zones can be designed in any manner. A special routine realizes zone connection through the return-air connections and calculates the state parameters of the individual components after their cooling on the heat transmitters. The energy flows due to heat transfer processes on the wall are determined by the numerical solution of the one-dimensional solenoidal heat conductivity equation. Calculation of the heat transfer figure is done according to Tagami's formulation model [6]. For the long-term phase, Tagami suggests an experimentally determined correlation. It is a function of the steam-air-mass ratio on the wall (see Figure 9).

The calculation of the flow conditions for the long-term sector of the disturbance case makes a strong entry in the ALFA 2 calculation model. This goes back to the fact that the prevailing temperature variations following pressure equilibrium between the zones demand a more accurate observation of the mass flows leading to a temperature equilibrium [7]. For this reason, ALFA 2 takes both pressure equilibrium flows and flows due to density differences (free convection) into account.

3. Calculation of a Coolant Loss Disturbance in the Containment of a Pressurized-Water Reactor With a 1,000 MW Power

Within the framework of the calculations, the complete breakdown of the main coolant line in the reactor area (cold strand) is presumed to trigger the accident. Energy removal from containment proceeds via heat conduction through the containment wall, the return-air cooling system and long-term cooling. The containment geometry has been approximated by four zones.

Figure 1 shows containment segmentation. The first zone includes the reactor shaft and represents the rupture area. The steam generator boxes and various small areas are included in the calculation with Zone 2. Both zones are connected via mass flow connections with the containment cupola (Zone 3). Zone 4 represents the



○ Fan
⊠ Air cooler

Figure 1. The Four-Zone Model of Containment for Calculation of a Coolant-Loss Accident in a Nuclear Power Plant With a 1,000 MW Pressurized-Water Reactor
1--Reactor shaft; 2--Steam generator boxes and various spaces; 3--Containment cupola; 4--Ring spaces; NLU return-air connection number

outer ring areas. Safety disks act as excess-current connections between the zones. A rupture mass flow, whose course is illustrated in Figure 2 is used as a disturbance variable for the short-term phase of the presumed disturbance case.

The results of the mathematical simulation show that the maximum pressure differences between the zones occur within the time span between 0 and 2 seconds. Pressure equilibrium between the zones is reached after about 25 seconds (see Figures 3 and 4).

The thermodynamic behavior of the accident atmosphere following the discharge phase is characterized by practical processes leading to a pressure and temperature removal in the containment. This is illustrated by the respective pressure and temperature variations in Figures 3, 4, 5.

The effect of the return-air cooling system on thermo- and fluid dynamics of the containment atmosphere can be seen in Figures 3, 5, 6, 7. The calculated pressure variations (Figure 3) for different parameters of the return-air cooling system show that an increase in cooling power and return-air mass flow will lead to a rapid pressure removal in the containment. Utilization of the return-air facility leads to a directed revolution of the accident atmosphere. Thus, local hydrogen concentrations can be reduced.

The calculation results have confirmed that the role of free convection flows is supplanted for the mass exchange between the zones by the return-air facility. This is clarified in Figure 7, where the mass flow course of the excess flow connection 3' is shown. On the other hand, one may conclude from Figures 5 and 6 that the convection flows in the presumed failure of the return-air facility contribute to a homogenization and to pressure reduction of the containment atmosphere. The mass exchange due to convection on the excess current connections leads to a temperature equilibrium between the zones (Figure 5). The convection loop forming on an excess current connection due to density fluctuations is approximated by an oscillatory decreasing function of ALFA 2 (Figure 7), the negative values indicating a flow return. Figure 7 also shows the different mass flow variations, taking into account convection or pressure equilibrium flows, as well as with operation of the return-air facility. If we look solely on pressure equilibrium flows, mass exchange no longer occurs between Zones 2 and 3 after about 150 seconds of accident time.

Considering the post-decay heat from the reactor core causes a delay in pressure and temperature reduction in the safety enclosure. The pressure course is distinguished

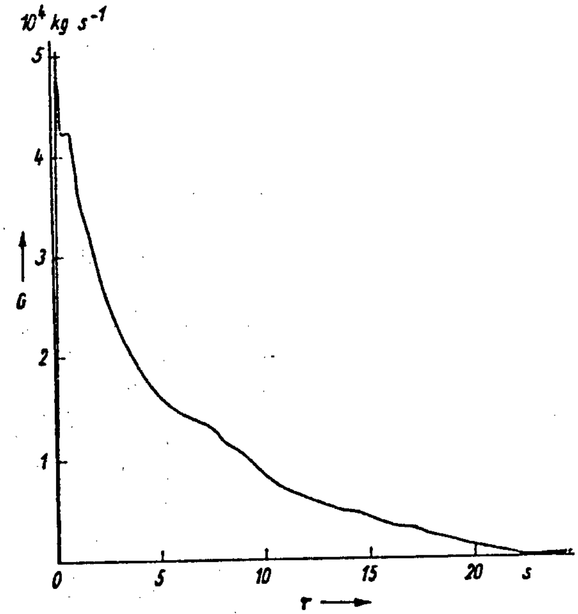


Figure 2. Rupture Mass Flow Into the Containment in a Coolant-Loss Accident [4]

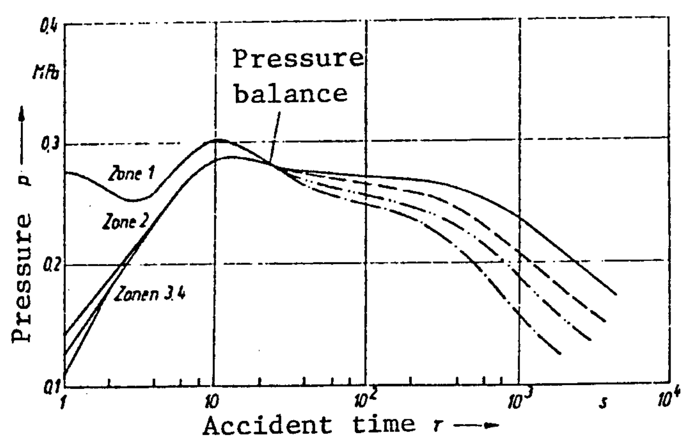


Figure 3. Coolant-Loss Accident in a Nuclear Power Plant With Pressurized-Water Reactor: Effect of Return-Air Cooling System on Pressure Course in Containment
——— without return-air cooling;
----- with return-air cooling, G_u = 60 kg/s, $\dot{Q}_u$ = 1 MW;
—··—·· with return-air cooling, G_u = 60 kg/s, $\dot{Q}_u$ = 10 MW;
—·—·— with return-air cooling, G_u = 100 kg/s, $\dot{Q}_u$ = 10 MW

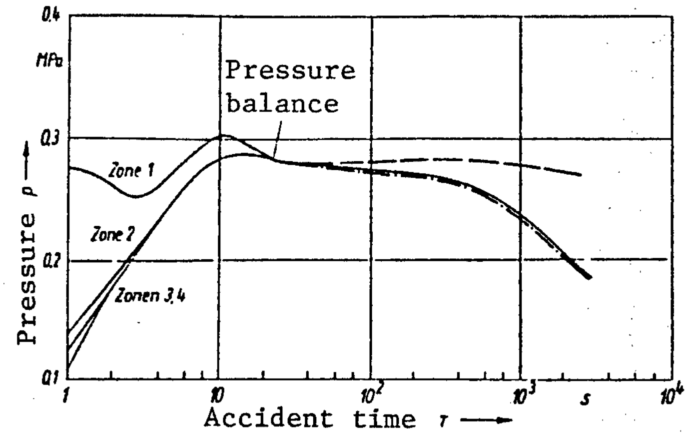


Figure 4. Coolant-Loss Accident in a Nuclear Power Plant With Pressurized-Water Reactor: Effect of Post-Decay Heat on Pressure Course in Containment
——— without post-decay heat;
----- with post-decay heat;
—·—·— with post-decay heat and return-air cooling;
G_u = 60 kg/s, $\dot{Q}_u$ = 1 MW

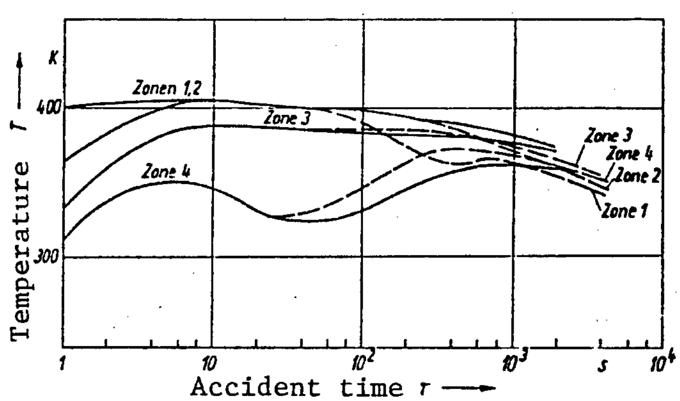


Figure 5. Coolant-Loss Accident in a Nuclear Power Plant with Pressurized-Water Reactor: Temperature Variation in Containment
——— without return-air cooling;
----- with return-air cooling, G_u = 60 kg/s, $\dot{Q}_u$ = 1 MW

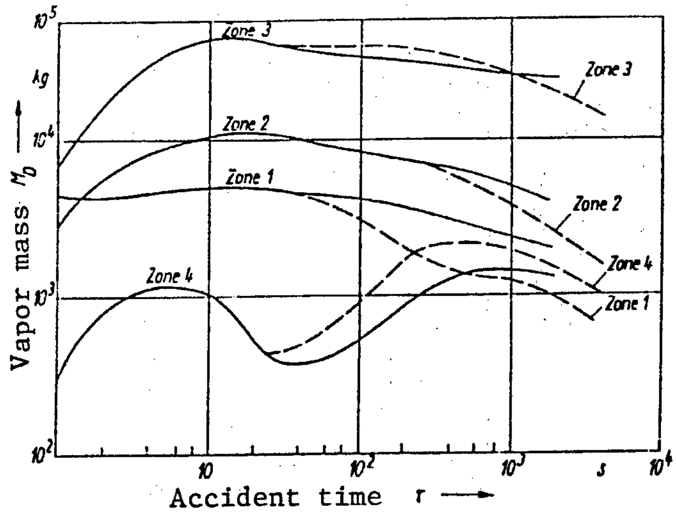


Figure 6. Coolant-Loss Accident in a Nuclear Power Plant With Pressurized-Water Reactor; Water Vapor Mass in Containment
——— without return-air cooling;
----- with return-air cooling, G_u = 60 kg/s, Q_u = 1 MW

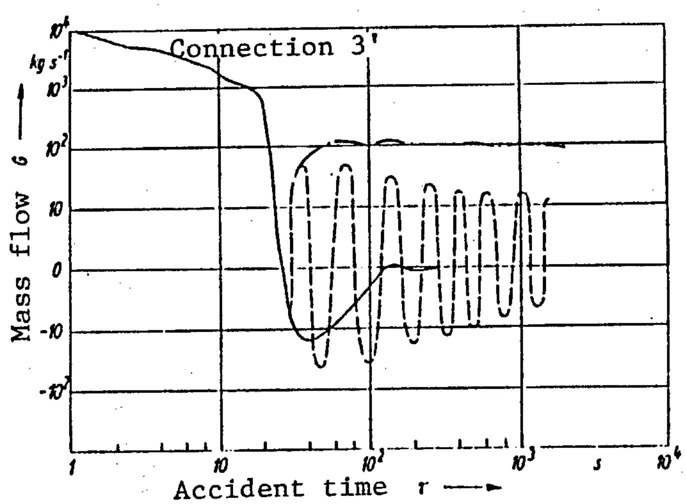


Figure 7. Coolant-Loss Accident in a Nuclear Power Plant With Pressurized-Water Reactor: Mass Flow Course on Connection 3' (Container Cupola - Steam Generator Space)
——— pressure equilibrium flow;
----- density and pressure equilibrium flow;
—·—·— with return-air facility, G_u = 60 kg/s, Q_u = 1 MW

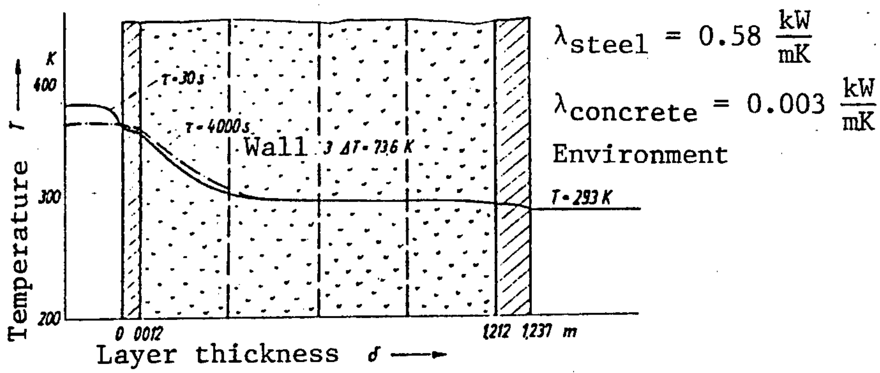


Figure 8. Coolant-Loss Accident in a Nuclear Power Plant With Pressurized-Water Reactor: Temperature Variation on Containment Cupola (Wall 3)

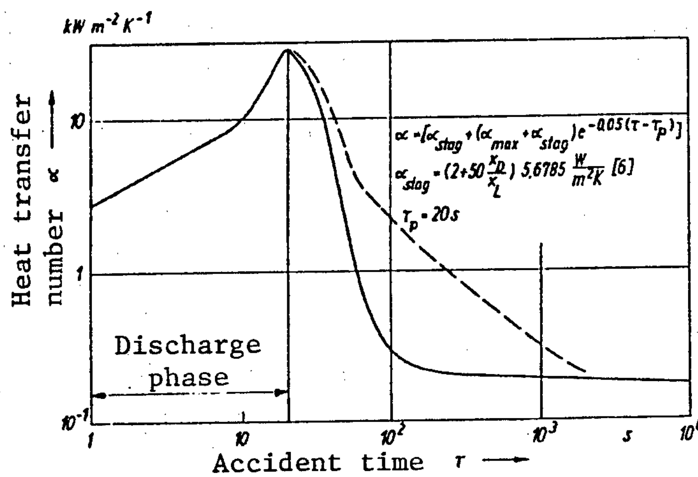


Figure 9. Coolant-Loss Accident in a Nuclear Power Plant With Pressurized-Water Reactor; Time Variation of Heat Transfer Value in Containment
----- rupture room;
——— containment cupola

under the effect of the post-decay heat by a slow rise to approximately 1,000 seconds accident time (Figure 4). Only with a further drop in post-decay power does the pressure in the containment drop. The temperature variations on the containment wall (Figure 8) illustrate the high inertia of heat transfer processes compared to the change in variables of state in the containment. Thus, the curves in Figure 8 show little difference after an accident time of 30 seconds and 4,000 seconds.

The calculation of the heat transfer value by means of the Tagami correlation furnishes for the most part coinciding results with experimental values from the test program DEMONA [8]. The advantage of the Tagami correlation used by ALFA 2 for the long-term phase is provided by the fact that the heat transfer value can be calculated during this phase as a function of α from the discharge phase. It is then possible to take the conditions of the discharge phase into account for a long-term calculation.

Figure 9 represents the time variations of the heat transfer value on the containment cupola and in the rupture area. The different courses of α in both zones show the effect of non-condensable gases on the heat transfer. Due to a reduction in air mass as compared to vapor mass, we arrive at a considerable improvement in heat transfer. This is illustrated by the curve of the heat transfer value in the rupture area.

4. Conclusions

Proceeding from an assumed coolant loss accident in a pressurized-water reactor, we made calculations in this study regarding the long-term behavior of the containment atmosphere with the ALFA 2 program system. Thermo- and fluid dynamics were in the foreground of the accident atmosphere.

Through simulation of the safety facilities, the return-air and long-term cooling system and ALFA 2, it was possible to arrive at conclusions regarding the effect of these safety systems on the thermodynamic condition of the containment atmosphere. The results have shown that the return-air facility contributes to a better homogenization of the containment atmosphere. Using it makes it possible to accelerate the pressure reduction in the safety enclosure. With an increase in the performance of the return-air system and optimal design of the return-air connections, it is possible to achieve rapid pressure reduction, so that the use of the sprinkler device and the negative effects of the spray medium are eliminated.

Notations

Symbols

G	Mass flow
h	Specific enthalpy
M	Mass
p	Pressure
Q	Amount of heat
$\dot{Q}$	Heat power
T	Temperature
v	Specific volume
α	Heat transfer number
τ	Time

Indices

a	Exit
D	Vapor
e	Entry
L	Air
l	Long-term cooling
s	Saturation state
u	Return-air cooling system
W	Water
wu	Heat passage

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TELECOMMUNICATIONS

Hungarian Telecommunications Upgrades Described

AN890153 Chichester INTERNATIONAL TELECOMMUNICATIONS INTELLIGENCE in English 7 Apr 89 pp 4-5

[Article: "Hungary Breaking the Silence"]

[Text] The Hungarian PTT, Magyar Posta (MP), which became a state-owned company in 1986, seems to be stepping out boldly ahead of the other five European Comecon countries towards expansion and modernisation of its telephone network. Soon after the relaxing of COCOM trade descriptions last September, the country signed a HF 7.2 billion ($140 million) contract involving the deployment of digital switches in eight Hungarian cities, including the capital Budapest, with an anticipated expansion to the network of 100,000 lines. The equipment is being supplied by Austria Telecommunications, a Vienna-based joint venture between Kapsch and Schrack, two Austrian electronics groups and distributors of Northern Telecom (NT) products. The local exchanges, produced on licence by Austria Telecommunications, are based on Northern Telecom's DMS 100 model and adapted to meet Hungary's networking specifications. Although NT was not involved in the deal, it said it "was delighted" that its (modified) exchanges had been selected.

Marking completion of the first phase of the contract, at the end of last month MP inaugurated the first digital exchange to serve Hungarian subscribers, in the Szombathely region in the west of the country. Hungary's first digital network on the edge of an otherwise analogue environment will bring modern telephone facilities to 120 villages (about 9,000 subscribers). Mr. Nemeth, the prime minister, led the inauguration ceremony.

The French company TRT (Telecommunications Radioelectriques et Telephoniques) supplied MP, through Austria Telecommunications, both with the interfaces between the new DMS 100-based digital exchanges and the existing analogue network and the IRT 1500 multi-access radio system. The radio system connects some 1,000 lines in this first phase of the Austrian company's contract.

The Coordinating Committee on Multilateral Export Controls (COCOM) represents all 16 NATO countries (except Iceland) and Japan. Its trade embargoes restrict the export of high-tech equipment from the West to the Soviet Union and Eastern Europe. As of 15 September 1988 a four-year-old ban on sales of digital public exchanges, digital PABXs and some fibre-optic cabling to the Soviet bloc was lifted. Consequently, there could now be an influx of Western suppliers of infrastructure-related equipment into the communist countries.

Hungary was the first to take advantage of the new ruling. A SKr 47 million ($7.5 million) order for an AXE international exchange in Budapest was signed with L.M. Ericsson of Sweden within the month. Ericsson delivered the 6,800-line transit switch in the middle of March 1989.

In response to U.S. objections, the embargo still stands on switching equipment beyond certain limits in capacity and power (in fact the US had not wanted to remove the ban until 1991), and on advanced semi-conductors and software. However, there is room left for flexibility within the export legislation of each COCOM member country, and they tend to tighten or relax their own restrictions on exports according to their individual requirements.

Hungary's MP had been a department of the Ministry of Transport and Communications (KPM), but three years ago it reverted to its pre-war status—the first Comecon (Committee for Multilateral Export Controls) [expansion as published] PTT to do so—as a separate legal body in its own right. Apparently it is now endeavouring to do away with the political privileges which typify government-run Comecon PTTs and to consolidate the public network. This could mean upgrading the public telephone network to a reliability comparable with the country's networks in other sectors and protected lines which together represent the equivalent of 40 percent of the public network. It is expected these private networks (such as those of the railway and oil industries) will be allowed to extend further as well.

The MP's ultimate target for expansion is an increase of 4,200 main subscriber stations by 1990, with a further 3.1 million stations to be added in the 1990s. Experts have estimated that during 1990, HF 21.7 billion ($400 million) will be spent on telecommunications development in Hungary; Magyar Posta has plans to invest HF 300 billion ($5.5 billion) by the end of the century. The World Bank lent $70 million in 1987 to this end.

It is expected that Hungary will address its existing impractical distribution of telephones. Currently only 50 percent of all Hungary's telephones are in provinces, despite the country's large rural population; the remainder are in Budapest. This means the main exchanges are overloaded, reducing the number of successful connections to less than 50 percent in peak periods. Some predictions put the proportion of main and sub-exchanges needing immediate replacement at 30 percent.

It has been estimated that Hungary loses more than HF 80 billion ($1.5 billion) because of the poor state of its telephone network. The system is decades behind those of Western Europe—for this the country may in part blame its compulsory requirement to contribute towards developments at the Comecon level, particularly satellite communications, to the detriment to its telephone network.

Before World War II, Hungary could boast the best telephone network in Eastern Europe. Now it is the worst, relative to the standard of living in the country, of the six European Comecon countries, with 600,000 people currently waiting for a telephone connection. The public is dissatisfied—and following the USSR's new wave of openness, it has been able to express its dissatisfaction and demand government reviews of the situation.

MP believes that its promised HF300 billion investment will bring the total number of telephone lines to 3 million from the current 1.7 million figure.

Saddled with antiquated equipment, deprived for so long of the latest advances in telecommunications technology from the West, and withheld from making modern developments of their own by the Comecon Council, the Comecon PTTs are almost totally unfamiliar with digital telecommunications technology. In Hungary this poses a serious economic problem for its telecommunications infrastructure industry in the light of the country's ambitious plans which embrace digital technology. Hungary and the other countries will probably try to secure local production and licensing agreements with Western companies under which domestic manufacture and subsequent export (outside the Soviet bloc) of Western products is allowed. Hungary appears to be the leader in Eastern Europe's slow migration out of the technological dark ages.

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